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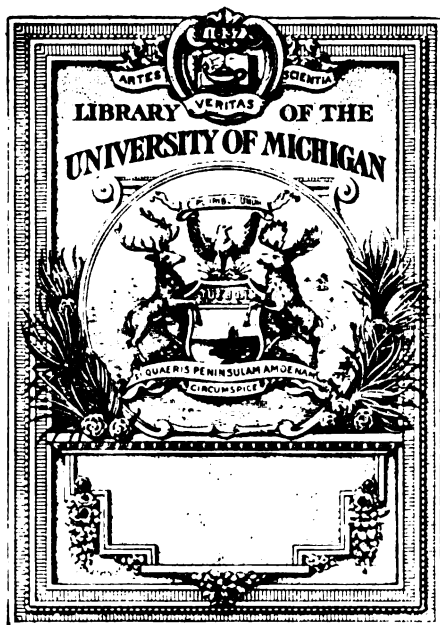
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ANNUAL REPORT

OF THE

PRESIDENT OF COLUMBIA COLLEGE

FOR THE YEAR 1885-86

MADE TO THE

BOARD OF TRUSTEES

MAY 3,



NEW YORK  
PRINTED FOR THE COLLEGE  
1886



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## PRESIDENT'S REPORT.

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TO THE TRUSTEES OF COLUMBIA COLLEGE :

The President of the College respectfully submits his annual report for the academic year ending June 9, 1886.

The first entrance examination for the year began, for the School of Arts, on Tuesday, June 2, 1886, and for the School of Mines, on Friday, June 5th, continuing in each case until Saturday evening, June 6th. The second examination began for these schools respectively on Tuesday, September 29th, and on Friday, October 2d, continuing again until the following Saturday evening. On Friday, October 2d, candidates for admission to the School of Political Science and to the Graduate Department were received, and also applicants for admission to the Collegiate Course for Women.

Scholastic exercises were regularly resumed on Wednesday, October 7, 1885, all the officers being present with the exception of Mr. Bertrand Clover, Instructor in Italian, absent on leave. Mr. C. L. Speranza was appointed to discharge the duties of Mr. Clover for the current year.

The tutorship in Latin held by Mr. Edward W. Hopkins having fallen vacant at the close of the academic year ending in June, 1885, it was resolved

that it should not be filled, but that there should be appointed instead two additional Fellows to be assigned to duty by the Faculty of the College with the approval of the President. The Fellows appointed under this resolution were Henry Alford Short, B.A., of the class of 1880, and Levi Harold Jacoby, B.A., of the class of 1885.

The following officers, whose terms of service expired by limitation with the close of the academic year ending June, 1885, were reappointed to their respective positions, viz. :

Thomas R. Price, Professor of the English Language and Literature.

Charles Sprague Smith, Professor of Modern Languages and Foreign Literature.

Hjalmar H. Boyesen, Gebhard Professor of the German Language and Literature.

William H. Carpenter, Instructor in German and the Scandinavian Languages.

Bernard F. O'Connor, Instructor in French.

Guillaume A. Scribner, Instructor in French.

Messrs. D. K. Dodge, W. C. Spencer, W. L. Robb, and H. J. Walther, Fellows in the School of Arts, whose tenure of appointment also expired in June, 1885, were reappointed for one year additional.

Messrs. Henry C. Bowen, Ferdinand G. Wiechmann, Herman T. Vulté, Alfred L. Beebe, and Charles E. Colby, Fellows in the School of Mines, whose terms likewise expired with the close of the academic year in 1885, were also reappointed for an additional year.

Alexis A. Julien, Assistant in Chemistry in the

School of Mines, was appointed Instructor in Microscopy and Micro-Biology in the same School.

Isaac L. Rice, Instructor in the preparation of legal briefs, and the use of legal decisions, was re-appointed, to hold office without limitation of term.

Samuel E. Stilwell, appointed October, 1883, to fill a vacancy in a Prize Fellowship of 1882, till then unfilled, was continued in his Fellowship for one additional year.

Nelson Glenn McCrea and Thomas Ewing, Jr., were appointed Prize Fellows from the graduating class of 1885.

All the foregoing appointments were made at the meeting of the Trustees held in June, 1885.

The following were made later in the year, viz.:

To fill vacancies : Thomas S. Fiske, Jr., Fellow in Science in place of William L. Robb, elected Professor of Physics in Trinity College, Hartford, and resigned.

Edward L. Stabler, Fellow in Science in place of Augustus D. Baker, deceased.

Halsted H. Frost, Jr., Fellow in Letters, in place of Walter G. Bates, retired.

Also Robert Arrowsmith, an additional Fellow in Letters attached to the Department of Modern Languages.

George H. Baker was reappointed to the Lectureship on the Bibliography and Literature of the Historical and Political Sciences.

Alfred J. Moses, Assistant in Mineralogy, was promoted to the position of Instructor in the same.

Robert D. Petty was appointed Prize Tutor in the School of Law, from the graduating class of 1885.

Edwin R. A. Seligman was appointed Prize Lecturer in the School of Political Science.

Michael Pupin, of the class of 1883, was appointed to the John Tyndall Fellowship for the Encouragement of Research in Physics.

Scholastic exercises have been regularly maintained in all the Schools, and in all the departments, throughout the year; and the President has had every reason to be satisfied with the zeal and devotion to duty displayed by the officers in their work, and with the results obtained. With a single exception, health has uninterruptedly prevailed among all the members of the academic staff. The exception occurred in the case of the Professor of Philosophy, Ethics, and Psychology, who, early in the year, became so much a sufferer that, under the advice of a physician, he asked and received a leave of absence in December, from which he was recalled in January on account of illness in his family, and was compelled, for the same reason, to ask an extension of his leave for the remainder of the academic year. His duties, in the mean time, have been discharged in the School of Arts and in the Graduate Department, by Mr. Nicholas Murray Butler, a Prize Fellow of the year 1882, who was for two years attached to the same department, and subsequently spent a year at the University of Berlin in the study of Philosophy and Pædagogogy; and who, by virtue of superior native gifts joined to assiduous cultivation, has shown himself to be peculiarly qualified for the work. The duty of the same Professor in the School of Political Science has been intrusted to Mr. Edwin R. A. Seligman, Prize Lecturer in that School from the class of 1885, who having

made a special study of philosophical theories of government for several years at Heidelberg and Berlin, is very thoroughly versed in that subject.

*Attendance : School of Arts.*—The number of matriculates in the School of Arts, for the year now drawing to its close, has been two hundred and forty-seven : of whom sixty are Seniors ; fifty-seven, Juniors ; sixty, Sophomores ; and seventy, Freshmen. Of these, eight have been discharged at request of parents. These, together with the sixty Seniors about to graduate, being deducted, there remain one hundred and seventy-nine undergraduate students at the close of the year, against one hundred and eighty-seven at the same time last year, showing a loss of eight. The number stated in the report of the undersigned for 1885 was actually one hundred and ninety-two instead of one hundred and eighty-seven, five students whose names were included in that total having been discharged after the close of the report.

Of these one hundred and eighty-seven, twelve failed to return to college after the close of the vacation, and six of those who returned, matriculated in the School of Political Science ; showing a loss to the School of Arts of eighteen, against twenty-two in 1884, twenty-seven in 1883, and thirty-five in 1882. The annual loss from this source seems thus, as pointed out in the last annual report, to continue to diminish.

*School of Mines.*—The total number of undergraduates in the School of Mines during the year has been two hundred and thirty-six, of whom seventy-three were in the first class, seventy-three in the second class, fifty-six in the third class, and thirty-

four in the fourth class. Of these, thirteen have become disconnected from the School, leaving at present two hundred and twenty-three only in attendance at the date of this report. Deducting from this total the number of the class about to graduate, now embracing twenty-eight members, there will remain at the close of the year one hundred and ninety-five, against one hundred and ninety-one in June, 1885.

*School of Political Science.*—There have been in attendance, during the year, seventy-three students, distributed as follows : In the third, or most advanced class, eight ; in the second, thirty-three ; and in the first, thirty-two—against a total in the preceding year of fifty-one, with thirteen in the third class, seven in the second, and thirty-one in the first.

*School of Law.*—In the School of Law the number in attendance has been three hundred and forty-four, of whom one hundred and ninety-eight were members of the Junior class, and one hundred and forty-six members of the Senior class. This total is less by twenty-three than that of the year preceding. The difference is accounted for by the fact that twenty-five or thirty candidates for matriculation in this school were excluded, from inability to comply with the requisitions in regard to prepayment of tuition fees.

Of the students in attendance on the School of Law one hundred and eighty-three were graduates of colleges, the number of colleges represented being forty-four. The largest number from any one college was thirty-one, from Columbia ; the next was thirty, from Yale ; the third from Princeton, twenty-eight ; and the fourth from Harvard, twelve.

*School of Medicine.*—In the School of Medicine the number of students in attendance during the year has been five hundred and two, being an increase of twelve over the year preceding.

*Graduate Instruction.*—The number of graduates who have been under instruction in the Department of Arts has been twenty, and in the School of Mines, four; total, twenty-four.

*Collegiate Course for Women.*—In the course of collegiate study provided for women there have been thirteen matriculates during the year.

The total of all the foregoing numbers amounts to fourteen hundred and thirty-nine; but from this number we have to deduct for repetitions forty-six, leaving a net total of thirteen hundred and ninety-three, against fourteen hundred and twenty-five of the year preceding.

## DEGREES CONFERRED IN 1885.

Degree.	I. SCHOOL OF ARTS.	Number.
Bachelor of Arts . . . . .		60
Master of Arts . . . . .		12
Doctor of Philosophy . . . . .		1
Doctor of Letters . . . . .		1
Doctor of Laws (honorary) . . . . .		2
	2. SCHOOL OF MINES.	
Engineer of Mines . . . . .		41
Civil Engineer . . . . .		4
Bachelor of Philosophy . . . . .		7
Doctor of Philosophy . . . . .		1
	3. SCHOOL OF POLITICAL SCIENCE.	
Bachelor of Philosophy . . . . .		4
Doctor of Philosophy . . . . .		5
	4. SCHOOL OF LAW.	
Bachelor of Laws . . . . .		129
	5. SCHOOL OF MEDICINE.	
Doctor of Medicine . . . . .		134
Total . . . . .		401

## RESIDENCES OF STUDENTS.

Residence.	School of Arts.	School of Mines.	School of Pol. Sci.	School of Law.	School of Med- icine.	Gradu- ate De- partm't.	Course for Women	Total.
New York City . . .	144	107	34	172	174	7	9	647
Brooklyn . . .	31	39	9	37	35	7		158
Jersey City . . .	3	6	1	8		1		19
N. Y. State. . .	37	30	12	42	83	4	3	211
New Jersey . . .	25	22	2	31	55	5		140
Alabama . . .					1			1
British Columbia . .					1			1
California . . .			2	3	3			8
Canada . . .				1	2			3
Central America . . .		1			4			5
Chicago . . .	1							1
China . . .				1				1
Connecticut . . .	3	3	2	5	33		1	47
Cuba . . .		1			1			2
Delaware . . .				2				2
Dutch West Indies . .					1			1
Florida . . .			1	1	3			5
Georgia . . .		1	1	1	2			5
Illinois . . .		2	3	8	3			16
Indiana . . .		2			4			6
Iowa . . .		1		1	3			5
Italy . . .			1					1
Kansas . . .			1	2	3			6
Kentucky . . .				2	3			5
Maine . . .	1				9			10
Maryland . . .		1		2	1			4
Massachusetts . . .			1	6	14			21
Michigan . . .		3			3			6
Mississippi . . .					3			3
New Brunswick . . .					1			1
New Hampshire . . .					4			4
North Carolina . . .					3			3
Nova Scotia . . .					1			1
Ohio . . .		3	1	2	10			16
Oregon . . .					1			1
Pennsylvania . . .		4	1	6	7			18
Rhode Island . . .		2			5			7
Salt Lake City . . .	2							2
South America . . .					6			6
South Carolina . . .				2	1			3
Tennessee . . .				1				1
Texas . . .					2			2
U. S. of Columbia, . .		2						2
Utah . . .		1						1
Vermont . . .				1	5			6
Virginia . . .		1		2	2			5
Washington, D. C. . .		3						3
Washington Ter. . .					1			1
West Virginia . . .					1			1
Wisconsin . . .			2	6	5			13



*Residences of Students.*—The preceding tabular statement exhibits the localities from which the students in our several schools during the past year have been derived. In this list it is to be understood that the term "New York State" signifies the State of New York exclusive of New York City and Brooklyn, and "New Jersey" signifies the State of New Jersey exclusive of Jersey City.

From this exhibit it appears that the students of our School of Arts are almost entirely from the city of New York or its immediate vicinity, while those attending the professional schools come from a wide range of territory. It could hardly be expected that the undergraduate course, however attractive, could draw students in numbers from a distance, unless provision should be made for their physical wants on as moderate terms as are offered by country colleges; and unless perhaps such surveillance could be exercised over them during their undergraduate life as those colleges professedly offer. But this would require so large an investment in buildings and grounds, mainly unproductive, as to absorb a large proportion of the capital of the College and seriously to paralyze its educational operations. It is not reasonable, therefore, to look for a large increase in the undergraduate attendance, at least for a good many years to come, nor perhaps is such increase greatly to be desired. The chief usefulness of the institution is to be found, in the future, mainly in its professional schools and in its graduate department; for the present principally in the former, but in succeeding centuries in that superior grade of teaching which takes its learners at the point where the course

in Arts ceases, and makes of them men of learning, philosophers, philologists, original investigators, or prepares them to be leaders of men in public life.

*Ages at Matriculation.*—The ages of matriculates in the School of Arts are taken for their last preceding birthday. A comparison of results for the last several years shows that the average age of entrance is at present nearly stationary at seventeen and a half years. If, however, the comparison be made between years separated by a wide interval, there will be discovered a tendency to a steady though very gradual advance. The following statement shows the particulars in regard to the classes matriculating in October, 1885 :

Class.	No. in Class.	Average Age.	Oldest.	Youngest.
Seniors,	60	20 $\frac{1}{2}$	26	18
Juniors,	57	19 $\frac{1}{2}$	25	17
Sophomores,	60	18 $\frac{1}{2}$	23	16
Freshmen,	70	17 $\frac{1}{2}$	26	15

It thus appears that the average age of the present Senior class at graduation will be about twenty-one and a half years, the extremes of age being twenty-seven and nineteen.

Now if we go back twenty years to October, 1865, we shall find the numbers following :

Class.	No. in Class.	Average Age.	Oldest.	Youngest.
Seniors,	32	19 $\frac{1}{2}$	25	18
Juniors,	35	18 $\frac{1}{2}$	21	16
Sophomores,	33	17 $\frac{1}{2}$	19	15
Freshmen.	45	16 $\frac{1}{2}$	22	15

It thus appears that the average age of entrance into Columbia College has advanced within the last two decades nearly an entire year ; and that this advance is not merely apparent, in consequence of an acci-

dental variation, is made evident by the fact that the difference is the same between whichever of the four classes the comparison is made. It would be interesting to carry the inquiry to a still earlier date, but unfortunately it was not the practice under former administrations to note the ages of matriculants upon the record. We have no means, therefore, of ascertaining with certainty what was the average age at which boys entered upon the college course early in the century ; but from oral information received from old alumni, and from biographical notices of such as become conspicuous in their lives, we learn that about the year 1800 graduation was frequent at ages much below that at which, under existing statutes, it is allowable for a boy to enter Freshman. One alumnus appears in our list of the class of 1758 whose printed biography states that he was born Sept. 1, 1749. Unless there is some error here, this was probably the youngest graduate ever invested with the baccalaureate in an American college.

This question of the ages of the undergraduates has a direct practical relation to the more important question which divides the opinion of educators at the present time, viz. : the propriety of maintaining in colleges a close curriculum of study, or of leaving the selection of studies to the option of the student. The elective system would find few advocates, it is to be presumed, if the average age of graduation were not to exceed seventeen or eighteen years. The same colleges therefore which, early in the century, wisely adhered to an invariable course of study, may at this time, with equal wisdom, concede to their students, at least during the later years, perfect freedom of

choice in the selection of their studies. This subject will presently be more fully considered.

*Scholarship.*—The following statement exhibits the average standing in scholarship attained by the students of the several classes during the first half of the present academic year, as derived from the term record and from the semi-annual examination completed in February last. For purposes of comparison the record of the entire preceding year (ending June, 1885) is given for the Junior, Sophomore, and Freshman classes of that year, being those only which are still in College. The record for the present year cannot be presented complete, inasmuch as the final examinations have not been held at the date of this report.

## SCHOLARSHIP.

### FIRST SESSION.—1885-86.

#### SENIOR CLASS.

Number in class . . . . .	57
Number above 90 per cent . . . . .	24 = to $\frac{2}{3}$ of the class.
Number between 80 and 90 per cent . . . . .	18 about $\frac{1}{3}$ " "
Number between 70 and 80 per cent . . . . .	10 " $\frac{1}{3}$ " "
Entire number above 70 per cent . . . . .	52 " $\frac{10}{57}$ " "
Average scholarship . . . . .	92.22 per cent.

#### JUNIOR CLASS.

Number in class . . . . .	51
Number above 90 per cent . . . . .	16 about $\frac{1}{3}$ of the class.
Number between 80 and 90 per cent . . . . .	19 " $\frac{2}{3}$ " "
Number between 70 and 80 per cent . . . . .	8 " $\frac{1}{3}$ " "
Entire number above 70 per cent . . . . .	43 nearly $\frac{1}{2}$ " "
Average scholarship . . . . .	81.95 per cent.

#### SOPHOMORE CLASS.

Number in class . . . . .	45
Number above 90 per cent . . . . .	10 = to $\frac{2}{5}$ of the class.
Number between 80 and 90 per cent . . . . .	17 = to $\frac{3}{5}$ " "
Number between 70 and 80 per cent . . . . .	9 = to $\frac{1}{5}$ " "
Entire number above 70 per cent . . . . .	36 = to $\frac{4}{5}$ " "
Average scholarship . . . . .	79.96 per cent.

## FRESHMAN CLASS.

Number in class . . . . .	56		
Number above 90 per cent . . . . .	10 = to $\frac{1}{11}$ of the class.		
Number between 80 and 90 per cent . . . . .	16 = to $\frac{1}{3}$ " "		
Number between 70 and 80 per cent . . . . .	11 = to $\frac{1}{11}$ " "		
Entire number above 70 per cent . . . . .	37 = to $\frac{2}{3}$ " "		
Average scholarship . . . . .	75.74 per cent.		

It will be noticed that the total numbers in the several classes as given in this statement fall short by some units of the numbers of matriculates as given above. This arises from the fact that, in a few instances, individuals, after matriculation and before the February examination, ceased to attend; and also that some of the matriculates have attended only in certain departments and not in others, and are therefore not included in the foregoing computation.

## SCHOLARSHIP—FOR THE ENTIRE YEAR, 1884-85.

## JUNIOR CLASS.

Number in class . . . . .	62		
Number above 90 per cent . . . . .	20 = to $\frac{1}{3}$ of the class.		
Number between 80 and 90 per cent . . . . .	23 = to $\frac{2}{3}$ " "		
Number between 70 and 80 per cent . . . . .	11 = to $\frac{1}{3}$ " "		
Entire number above 70 per cent . . . . .	54 = to $\frac{2}{3}$ " "		
Average scholarship . . . . .	80.34 per cent.		

## SOPHOMORE CLASS.

Number in class . . . . .	58		
Number above 90 per cent . . . . .	7 = to $\frac{1}{8}$ of the class.		
Number between 80 and 90 per cent . . . . .	14 = to $\frac{1}{4}$ " "		
Number between 70 and 80 per cent . . . . .	16 = to $\frac{1}{3}$ " "		
Entire number above 70 per cent . . . . .	37 = to $\frac{2}{3}$ " "		
Average scholarship . . . . .	74.09 per cent.		

## FRESHMAN CLASS.

Number in class . . . . .	60		
Number above 90 per cent . . . . .	16 = to $\frac{1}{4}$ of the class.		
Number between 80 and 90 per cent . . . . .	14 = to $\frac{1}{3}$ " "		
Number between 70 and 80 per cent . . . . .	10 = to $\frac{1}{6}$ " "		
Entire number above 70 per cent . . . . .	40 = to $\frac{2}{3}$ " "		
Average scholarship . . . . .	76.60 per cent.		

It will here be seen that all the three classes which were in the College during the preceding year have improved their average standing. That was to be expected of the present Junior class, which passed at the beginning of the present year from a close curriculum to one in which the studies are to a considerable extent elective ; but the advance (from 74.09 to 81.95—nearly eight per cent.) is too great to be accounted for wholly in that way. It has been measurably due to the diminished number in the class, it being usually the most deficient who drop out and thus cease to exert a depressing effect upon the general standing. To the same cause must be chiefly ascribed the apparent improvement observed in the average Senior standing, which has advanced from 80.34 to 92.22, or almost twelve per cent., a very unusual increase to occur in a single year.

These estimates of average scholarship are founded of course upon the valuations given to the performances of individuals in the monthly reports of the instructors and in the semi-annual examinations. While a good deal of exception has been taken to this mode of estimating scholastic merit, no other has yet been proposed which has proved generally acceptable ; and possibly, so long as it shall continue to be thought advisable to arrange names in a graded list, no better will be found. Yet to the general objections which have always existed to the marking system in any form, there has been added, since the adoption of the plan of elective study, a special and more serious one. It may happen, for instance, that two members of the same class may make selections of studies which have nothing at all in common. Such cases are not infre-

quent. In looking over the list of electives in our present Senior class, there will be found such wholly dissimilar groups as the following, viz. : one student selects astronomy, physics, calculus, geology, and chemistry ; and another the constitutional history of Europe, the history of England, psychology, political economy, and Spanish. There is no common standard by which to compare the merit of performances between individuals pursuing studies so widely incongruous as these ; and hence it is but doubtful justice to place one of the competitors above or below the other.

To the undersigned it would seem to be preferable to abolish graded scales altogether, and to make public no other scholastic distinctions than *proficient* and *deficient*. This need not prevent the affixing a numerical valuation to the performances of each student in each particular study, in a record kept for the consultation of the Faculty, in case any question should arise affecting such student individually. This is the plan which has been followed in the School of Mines ever since it was opened, more than twenty years ago, with results entirely satisfactory. It was not imposed by authority, but grew up naturally as the simplest test for the accomplishment of the object for which the School was instituted, viz. : to make well-qualified engineers. If we should, in like manner, in the School of Arts, limit our endeavors to the effort to make well-educated young men, and cease to trouble ourselves with questions of their relative merit, then there can be no doubt that the results would be equally satisfactory. An incidental advantage, moreover, would be derived from the change, viz. : that we

should hear no more of the frauds in examination concerning which recently so much has been said, and concerning which statements have been published of absurd and disgraceful exaggeration.

There is no doubt that there is a great deal of effort made in all colleges to deceive examiners by the use of fraudulent devices in the filling out of examination papers ; but any sensible man who will study the nature of the problem, will easily perceive that success to any important degree in such an undertaking is a moral impossibility ; and even though it should be strictly true, as has been confidently asserted, that such attempts are made by three out of four, or, as others say, nine out of ten, of the entire body of the students, this fact is only evidence of the general prevalence of a hope, and not by any means a proof of an accomplished result. But it is further evidence of a sad degree of demoralization among young men pursuing together a course of liberal education, which it is desirable to eradicate at any cost.

*Discipline.*—" Happy is the people," it has been well remarked, " which has no history." Considering that, in the past centuries, the histories of most peoples have been principally narratives of wars more or less disastrous with foreign nations, and struggles more or less exasperated between factions at home, the remark is not without its justice. And a similar remark may be made with equal truth of an educational institution which has nothing to record worthy of the historian's pen. This is what we are justified in saying of our own College for the past year and for many years preceding. It is with pleasure that the undersigned testifies here to the uniform good order and



quiet attention to duty which have distinguished the students of all departments of the institution throughout the year. Happily this good fortune is not our own exclusively. All the colleges of the country in fact seem to be gradually working themselves free from those frequent disturbances of the peace to which they were once liable, and which have been rather an evil transmitted by inheritance, than a proper malady of our own time; but of our College it may be said that it has never been to a great degree a sufferer from this cause, and that, in point of respect for law, courtesy toward instructors, and uniform observance of the principles of gentlemanly propriety on all occasions, its undergraduate body has established a character no less honorable to them collectively than advantageous to them individually.

*Elective Studies.*—Opinions of educationists have long been divided on the question whether, or to what extent it may be proper to allow to undergraduate students in college freedom of choice in the selection of their studies. The discussion, after having apparently begun to flag, has been recently resumed with more activity than ever. Until some time later than the beginning of the present century, it is believed that in every college in our country an invariable curriculum of instruction was rigorously enforced. When at length there began to be admitted some slight relaxation of the severity of this rule, the earliest steps taken were cautious in the extreme, and so slight as to be almost insignificant. At Yale College, up to a quite recent date, the liberty of choice was allowed to the student only during three months of the Junior year, and embraced no studies except

Fluxions (the Calculus), Hebrew, Greek, French, and Spanish. An interruption of so brief duration could scarcely affect sensibly the general character of the course. In our own College no option in the selection of studies was allowed until 1864, when the Calculus was placed on the optional list ; but as this subject had not for some time previous been taught at all, the innovation hardly produced a sensible change. To those who selected the subject one hour was allowed weekly during the Senior year in place of Greek. It was not until 1872 that the elective system was avowedly admitted into the College, and then only for the Senior year and partially. Of the fifteen hours of instruction in class weekly, eight continued to be occupied with obligatory studies, while for the remaining seven a choice was allowed among a considerable range of subjects, including Greek, Latin, the Calculus, mathematical Physics, and Philosophy. Eight years later, this liberty of choice was materially enlarged and extended to the Junior year also. With the Junior class obligatory studies were limited to four hours per week, and with the Senior to two hours only. The French, German, Italian, and Spanish languages, moreover, having been in this year made a part of the regular curriculum of study in every one of the four years of the College course, an option between these languages was given to the Sophomores and Freshmen for two hours per week ; each individual to be confined to a single language. In 1884, this system received a new modification, with the Senior class in the way of extension, and with the Juniors in that of restriction ; all the Senior hours being devoted to elective studies, while with

the Juniors the free hours were reduced from eleven to five. This last change as to the Junior class was made by the Trustees on recommendation of a majority of the Faculty—a majority in which the undersigned was not one and concurring, having opposed the adoption of the recommendation by his vote, though unwilling in a matter of so great educational interest to interpose a veto. This explanation is made that his position upon this question may not be misunderstood. It is probably too early as yet to appeal to results as a test of the wisdom of the change; but there is already reason to believe that they have not been in all respects advantageous. It is known, for example, that, in a number of instances, parents in New York who had designed to enter their sons in this College have sent them elsewhere, in consequence of the limitation put by this recent action upon the freedom previously allowed in the selection of studies during the Junior year.

Most of the leading colleges of the country are admitting the elective principle more or less freely. In 1876 Yale College extended her very limited optional list above mentioned from a minute fraction of the studies of the Junior year to about one fourth of those of both Junior and Senior years. Only last year she has once more enlarged it, so that now, out of sixteen hours weekly, seven only are given to prescribed studies in the Junior year, and three hours only in the Senior. At Princeton one third of the time is given to elective studies weekly during the Junior year, and more than one third during the Senior. At Bowdoin about four fifths of the studies are prescribed during both Junior and Senior years.

At the University of Pennsylvania, and at Williams College, the published announcements indicate that the time of the two later years of the course is about equally divided between prescribed and optional studies. At Rutgers it is allowed to elect one study during the Junior and Senior years. At Union one third of the time is given to elective studies during the Senior year only ; but this institution offers also elective courses, a classical and a scientific course running through the entire four years. At Brown electives are offered as early as the Sophomore year, when they occupy about one fifth of the time. In the same institution, in the Junior year, they extend to one third, and in the Senior to about one half. At Amherst electives cover about one half the time during the second and third of the three terms of the Sophomore year, and during the whole of the two later years. In the University of Michigan all the studies are elective after the close of the Freshman year ; and at Harvard University it is matter of notoriety that there are no prescribed studies at all.

In this variety of practice, while it is obvious enough that the colleges of the country are steadily drifting away from their policy, so long stoutly adhered to, of maintaining a severely prescribed curriculum of study, we look nevertheless in vain for any distinctly apparent principle guiding and determining their action. This new departure would in fact seem in many instances to have been entered upon rather in deference to a presumed popular demand, than as a consequence of any very profound study of the principles of educational philosophy. To a certain extent, however, it has been forced upon college

authorities as a necessity resulting from the multiplication of the subjects with which they have overstocked their scheme of operations. This enlargement of the amount of matter professedly taught has carried with it the inevitable alternative of superficial teaching on the one hand, or the restriction of each student, on the other, to a portion only of the entire programme offered. Many of the subjects introduced, since this century began, into the scheme of collegiate instruction, have been admitted on the ground of their usefulness, the assumption being tacitly made that the most important business of the college is to instruct rather than to educate. And when it has been objected that the effect of these additions was to crowd out the studies heretofore regarded as essential to thorough mental discipline, the reply has been ready that the new studies are just as efficacious to this end as those which they displaced. On this point there has arisen an active controversy, the parties to which are not likely to be reconciled. Whatever on that point may be the decision, it is an unfortunate consequence of the adoption on a large scale of the elective principle, that the significance of college degrees is likely in future to be sensibly neutralized and their value depreciated. This evil might be obviated if colleges everywhere were to adopt the rule of the University of Virginia, to confer a degree in Arts only on such as use their freedom of option in the choice of studies in such a way as to bring their course into practical conformity with the curriculum for which such degrees were first granted ; all others to receive degrees of different names, or certificates of proficiency without titular degrees.

But though the principle of election in study has been in many institutions adopted as to some extent an unavoidable necessity, it has been generally felt that to allow it to cover the whole undergraduate course would be a serious error. In the opinion of educators generally such an extension would be to defeat the main object for which colleges exist, which is to develop, by judiciously directed exercise, the intellectual faculties of men, and to train them to habits of systematic and sustained activity, such as may fit them to engage with effect in any species of effort which may lie before them in life. And whatever may be the views of some new lights in educational philosophy, it is not the general belief that this object can be effected by substituting any miscellaneous group of subjects of study chosen at random, in place of that body of judiciously chosen and felicitously associated subjects which have, down to a recent date, constituted the close curriculum under which our fathers qualified themselves for degrees in Arts. The majority of colleges, therefore, while admitting the principle of election, have restricted it to the later period of the undergraduate course, some confining it to the Senior and even to a portion of that year, others extending it wholly or partially into the Junior year, and a few carrying it back into the Sophomore. In one noted instance above referred to, all the studies of the college course, from the beginning of the Freshman year onward, have been made elective.

As in comparing the varieties of practice of the colleges in this matter we discover no general principle determining their action, so neither in their publi-

cations do we find any explanation of these diversities. The general preservation of the close curriculum during the earlier years would seem to be a consequence of an abiding conviction that the essential end of a liberal education, viz., the systematic training of the mental faculties, cannot be secured without it. The abandonment of the same in the later years is evidently an expedient rendered necessary by the fact that the number of subjects which the institution has undertaken to teach is too great to be crowded into a course of study imposed upon all. It is the latter condition principally which seems to have determined the point at which the line has been drawn in different colleges, between the obligatory and the elective studies, and which has fixed it earlier or later according as the pressure has been greater or less. Every college naturally desires to make its scheme of instruction as comprehensive as its resources will allow; and every enlargement of this scheme seems an additional step toward the attainment of that character which all are ambitious to acquire—that of a school of universal knowledge. But as the resources of different institutions are unequal, it will always happen that some are materially in advance of the rest.

Considerations of this character, however, were not those which fifteen years ago determined the introduction of the elective system into Columbia College. This step was taken in consequence of the observed fact that our students at the close of their third year in college have in general reached an age to which educational theories of study as a mental discipline are inapplicable, and at and after which the more legitimate end of study is the increase of knowledge.

During the period of childhood and early youth the power of educational influences is very great, and they may accomplish much in giving tone to the intellectual character ; but they are impotent to determine its distinctive quality or to obliterate or transform the stamp which has been impressed upon it by the hand of nature. Education is not a necessity to the *growth* of the mind any more than to that of the body. The minds of savages grow, and those of the little street Arabs for whom nobody cares, who attain often nevertheless, in the rough schooling of the world, a sharpness of cunning which enables them often easily to outwit the most highly cultured intellects among the more favored classes socially superior. It is during this period of growth that the mind like the body is amenable to educational influences. There are handicrafts which can never be perfectly acquired unless commenced in childhood. An adult may learn to speak a foreign tongue sufficiently well to be understood, but never so well as to make it pass as his vernacular. So if a limb be kept during the growing period in a state of enforced rest, it will shrivel and become atrophied, while if it be kept constantly and energetically in action, it will attain abnormal proportions. In like manner the mental faculties if, by a judiciously selected course of study, they be maintained during the same growing period in a state of healthful activity, they will attain a vigor which they could not have spontaneously acquired. But experience has shown that in a given individual mind all the faculties are not equally responsive to the influences employed to excite them ; and that of many minds subjected to the same disciplinary regi-



men, no two will strikingly resemble each other in the results of their development. In one the imagination will be the prominent faculty, in another the understanding. One will find the highest satisfaction in the study of natural forms, another in the investigation of natural forces. To one the structure of language will afford a favorite field of inquiry ; to another the creations that are built up out of it, poetry, oratory, history, fiction. One will revel in exact science, another in abstraction and speculative philosophy. The effect, therefore, of disciplinary training during the period of mental growth is to develop and bring into activity the distinctive characteristics of each mind, and to discover the field in which each is most capable of putting forth effort successfully. When this point is reached, to compel an individual to occupy himself with efforts for which he is constitutionally unfit, is a serious educational error. We are justified in saying, therefore, that the work of education, during the period of mental growth, is, in great measure, whether consciously to the teacher or not, a tentative work, of which the result is to ascertain, in each particular case, what the individual is fit for. After that the course logically indicated is to occupy him with that for which he is fit.

During the growing period the studies should be so varied as to offer to every faculty of the mind an equal inducement to exert itself—to provoke it, so to say, to activity. If, in any case, there should happen to be no predominating characteristic, all the powers will yield equally to the solicitation, and there will be produced—what is so often spoken of as desirable, and so generally assumed to be universally attainable,

but which is so rarely seen—a truly rounded culture. The more usual result, however, is that the tentative process brings strongly out some peculiarity, some idiosyncrasy, which makes a man more or less one-sided in his mental character, and incapacitates him for prosecuting effort with equal success indiscriminately in all directions. This point can hardly be said to have been conclusively reached until the mind has attained the period of natural maturity; the period, that is to say, at which it would mature if left to develop itself unaffected by any constraining scholastic influences. Previously to this it retains more or less the plasticity which distinguishes the period of childhood, and is capable to some extent of modification of character. At maturity it takes its final shape, and although by exercise it may gain in strength, it undergoes no further change in respect to the balance of its faculties.

The point, therefore, at which, in a continuous educational course, an obligatory curriculum of study should give place to unlimited freedom of choice on the part of the student, should be fixed rather with reference to maturity in years than to the degree of advancement in the four years' round of college study—a round substantial invariable for all colleges, however they may differ with each other in the average ages of their students. If this principle is admitted, the important inquiry will be, what is that degree of advancement in age, at which a human being may be supposed to have become so far intellectually developed as to have made his natural and unalterable mental constitution distinctly apparent.

The answer to this question may be derived from

psycho-physiological considerations, or from the general judgment of past generations as inferred from the age at which, during the seventeenth, eighteenth and the earlier part of the nineteenth century, a period during which an invariable curriculum of study was enforced in all our colleges, it has been usual for young men to complete their undergraduate studies. Looking at this question from the first point of view, it is matter of common observation that the human form, in its normal growth, attains its full dimensions at or about the end of the nineteenth year, or if there is any further growth after this period it is insignificant. What is true of the osseous and muscular tissues, it is reasonable to suppose must be equally so of the brain; and in point of fact it is found that the understanding is fully developed in young men and young women at an age not over nineteen. After this age, therefore, all educational discipline persisted in in the hope of stimulating into vigor and activity faculties which have refused to respond to the solicitations of previous years, is for the most part thrown away. And from this time forward there can be no doubt that the most advantageous results will be obtained by presenting to the mind only those subjects which are most in harmony with its own constitution and with which it is most fitted to deal.

If again we look for evidence of the views of past generations on this subject, we shall arrive at a conclusion entirely identical with the foregoing. They will be found if we can ascertain the average age at which young men graduated from college a century ago. Unfortunately no one has hitherto endeavored to collect the statistics of this question, and the data

are scattered. They can be obtained at all only for persons conspicuous enough to have had the particulars of their lives recorded in cyclopædias or biographical dictionaries. As the result of a hasty and extremely cursory inquiry, the undersigned, in his annual report for 1880, presented a list of eighty-one eminent men, all of them graduates of the early years of this century or earlier, and none of whom graduated at a more advanced age than eighteen. In a recent inquiry of the same kind, six hundred consecutive pages of a cyclopædia have been examined, and in these have been found notices of two hundred and thirty persons, whose ages at graduation were given, of whom none graduated later than the middle of this century, and most of whom belonged to the two centuries preceding. As to graduating ages, these two hundred and thirty are distributed as follows :

Age.	Number.	Age.	Number.
9 . . . .	1	20 . . . .	24
13 . . . .	3	21 . . . .	22
14 . . . .	3	22 . . . .	23
15 . . . .	7	23 . . . .	18
16 . . . .	6	24 . . . .	10
17 . . . .	19	25 . . . .	6
18 . . . .	36	26 . . . .	8
19 . . . .	43	31 . . . .	1
<hr/>		<hr/>	
Total to 19	118	Total 20 to 31	112

It appears from this exhibit, that the age at which the largest number graduated was nineteen, and the age at which, next in order, graduations were most numerous, was eighteen. The average age, of all up to nineteen inclusive, was seventeen and a half. The average of the entire number was 19.87, which, as will be seen from the statement given earlier in this report, corresponds very nearly to the average age of

our students at present at the end of the Sophomore year. In an inquiry like the present, however, graduation at advanced ages (above twenty-three, for example) should be allowed little weight ; for there are many young men, those of limited means especially, whose entrance into college is by force of circumstances delayed much beyond the time when they would willingly have entered, had it been possible. In the college class of the undersigned, for instance, in which the average age at entrance was about fifteen, there were three or four over twenty-five, and one over thirty-two. It is furthermore to be observed that, in the above enumeration, numerous graduates of the U. S. Military Academy are included ; and that, for some reason not apparent, but possibly political, the average age of graduation is considerably more advanced in the Academy than in civilian colleges.

The conclusion is therefore justified, on all grounds on which the question can be placed, that after the age of about nineteen years, it is the most judicious educational policy to adapt the studies of the individual to his clearly ascertained mental characteristics. This may be done either by prescribing to him such a course of study as his instructors may judge, as the result of observation, to be best adapted to his capacities, and therefore most likely to be profitable to him, and requiring him to pursue it ; or by giving to himself the liberty to choose such as are most in harmony with his tastes. Either course will naturally lead to results substantially similar ; but better than either would be a combination of the two—that is to say, to permit the student to choose, but to require him to submit his choice to his instructors for ratification.

The plan of elective study adopted in this College in 1880 was in accordance, in the main, with this theory. An almost unlimited freedom in the choice of studies was permitted to the Junior and the Senior classes, history, political economy, and the English language and literature only being obligatory ; these being regarded not as disciplinary studies, but as being a part of that knowledge which should be possessed by every well-educated man. From the reports of the undersigned for the years 1882 to 1885 inclusive, it appears that the consequences following the introduction of this system, in the improvement of the scholarship of the Junior and Senior classes, were striking and palpable. In Nov., 1884, however, the freedom of election in the Junior class was largely restricted, being reduced from eleven hours per week to five. As this change was directed after the academic year 1884-5 was considerably advanced, and therefore after the elections for the year had already been made, it could not be carried into effect until October, 1885, and it is as yet too early to draw any inferences as to the consequences of the change as regards scholarship ; the records which have been gathered under the new system covering a period of only four months. One result, however, which was not anticipated and was certainly not intended, has been to reduce considerably the number of persons electing the modern languages, especially the German, after the Sophomore year. The new rules prohibit to the two lower classes the choice of any foreign language but the French or German, unless for very special reasons approved by the head of the department ; and they, moreover, require that the language

originally elected in the Freshmen year shall be persisted in to the end of the Junior year, if any modern language is chosen in that year at all. But inasmuch as no modern language is among the compulsory studies of the Junior year, it happens that the privilege allowed to the Juniors in this matter is negative rather than positive—that is, not a privilege to elect a modern language, but a privilege not to elect any at all. Thus it happens that the operation of the rule is prejudicial to the department, and reduces rather than increases the attention paid to the modern languages in College. It is worth consideration whether the system as it existed previously to Nov., 1884, might not, with propriety, be restored.

The following statements will show the relative numbers of individuals who have this year elected each of the several studies offered to their choice.

## I. STUDIES ELECTIVE BY BOTH JUNIORS AND SENIORS.

	Seniors.	Juniors.	Total.
Number in class . . . .	60	57	117
Greek . . . .	38	18*	56
Latin . . . .	31	17*	48
Mathematics . . . .	8	27	35
Physics . . . .	20	35	65
Botany . . . .	9	23	32
French . . . .	27	22	49
German . . . .	16	13	29
Spanish . . . .	20	1	21
Italian . . . .	4	2	6

\* Besides this elective Greek and Latin, the same languages are compulsory for the Junior class, two hours per week throughout the year.

## STUDIES ELECTIVE BY SENIORS ONLY.

	Number electing.
Number in class . . . . .	60
English . . . . .	24
Astronomy . . . . .	40
Philosophy . . . . .	21

	Number electing.
Chemistry . . . . .	11
Political Economy . . . . .	15
Constitutional History of Europe . . . . .	16
Constitutional History of England . . . . .	8
Geology . . . . .	17
Anglo-Saxon . . . . .	24
Hebrew . . . . .	3

## MODERN LANGUAGES ELECTIVE BY SOPHOMORES AND FRESHMEN.

	Sophomores.	Freshmen.	Total.
Number in class . . . . .	59	68	127
French . . . . .	33	37	70
German . . . . .	23	31	54
Italian . . . . .	2		2
Spanish . . . . .	1		1

The relative numbers in the entire College electing modern languages are :

	Numbers electing.
Total number of students . . . . .	247
Number electing French . . . . .	119
“ “ German . . . . .	83
“ “ Spanish . . . . .	22
“ “ Italian . . . . .	8

Attention was called in the last annual report of the undersigned to the fact that the study which had been elected by the largest number free to choose, was the Greek. For every previous year since the system was established, both Latin and physics had stood above this language in the order of apparent acceptability. In the present year physics has resumed its advantage, but Greek continues to lead all the rest. What makes this the more remarkable is that Greek is compulsory during three years of the course and yet is a favorite elective besides. It is gratifying also to note that so severe a study as the mathematics is sensibly gaining in favor, and commands the choice of a third part of the number to



whom it is offered. Among Senior electives, astronomy, as usual, easily leads ; and Anglo-Saxon has made an extraordinary advance, having the preceding year been elected by only a single individual.

*The Department of Modern Languages.*—Instruction in the principal languages of western continental Europe, after having been attempted once or twice in the earlier history of the College with imperfect success, was finally, in 1880, permanently established as a part of our scheme of undergraduate instruction, and it has been maintained to the present time with results, in an educational point of view, quite satisfactory. In 1881 a scheme of instruction in this department was planned and approved by the trustees, extremely comprehensive in its character, contemplating a continuous course in each language from the first rudiments up through its philology and literature, covering the whole undergraduate period and finding its culmination in the department of graduate instruction. And considering the fact that undergraduate students, at the time of their entrance, are in many cases to some extent familiar with one or more of the modern languages, it was provided that, for purposes of instruction in these languages, students should be classified according to their proficiency, and without reference to the degree of their advancement in college standing. In this way it was possible from the beginning to form, in some languages, classes of different grades ; but with the progress of time the number of such grades naturally increased ; and the lapse of some years was necessary before the entire scheme was fully represented in practice. The gradual increase in the number of

sections or classes under instruction, involved of necessity, an increase in the number of instructors ; and it was only by experiment that it could be definitely ascertained what the permanent strength of the corps of instruction in the department ought to be. It is now more than a year since this point has been made so clear as to suggest the expediency of organizing the department in such a manner as to secure stability in the *personnel* and the methods of all its ramifications. It would be possible, no doubt, to maintain nominally a system of instruction in all these languages, by employing teachers who would be content to serve for brief periods with very moderate remuneration, and to replace them on their retirement with others of the same grade ; but if our instruction is to have a substantial value, if we desire to produce scholars and not mere sciolists, each one of the branches of this department must be represented in it by a man who is himself a scholar and an authority. In other words, ultimately, an independent chair must be created for each of the principal modern languages, a policy which was inaugurated in our College, prematurely as it proved, half a century ago. But in anticipation of the full maturity of our system, it is apparently indispensable that there should be appointed adjuncts to the principal professor sufficiently compensated to insure their permanence in office, and thus to secure to our teaching of modern languages that thoroughness and consistency from year to year which permanence only can make possible. We have already a professorship of German, filled by a very accomplished professor who is occupied mainly with the literary side of the

subject. For the philological branch we have a scholar who adds to his knowledge of German an acquaintance with the Scandinavian languages and literature, in which he is unsurpassed by any scholar in this country, and whom it would be a serious misfortune to our College to lose. In French philology we have also an instructor of whom, in his specialty, we are justified in making the same observation. These gentlemen have been attracted to our College in view of its avowed purpose to build up here a model school for instruction in the modern languages and their literature; and in the hope of making themselves permanently useful here. The undersigned, convinced of the necessity of placing this department upon a more satisfactory footing than it occupies at present, and satisfied of the superior merit of the instructors above mentioned, ventures to renew here the recommendation of his last annual report, that these gentlemen be promoted to the grade of adjunct professors in the department of Modern Languages.

*Department of Philosophy, Ethics, and Psychology.*

—At the meeting of the trustees, held June 1, 1885, a communication was laid before the Board from the Professor of Philosophy, Ethics, and Psychology, representing the need of some assistance in his department in order to secure satisfactory instruction in the variety of subjects for which he is made responsible. These subjects embrace Logic, Ethics, Psychology, and the History of Philosophy, with undergraduate students; the history of Philosophical Theories of Government, with students of the School of Political Science; together with advanced courses

in any of these subjects which may be demanded by students in the Graduate Department. The professor represented that to perform thoroughly all the work assigned him in the programme was beyond his strength ; and he asked that an adjunct might be appointed to divide with him the burden. The communication was referred to the Committee on the Course and Statutes with instructions to inquire and report. The undersigned, in letters addressed to members of the committee, endeavored to reinforce the considerations presented by the professor, by pointing out to what a degree our College is at a disadvantage when compared with sister institutions which come most directly into a competition with us, and by bringing strongly to their attention the hardly creditable fact that, at present, no instruction at all is given in our College in the important subject of Ethics. Inasmuch as the long vacation of the summer immediately succeeded this reference, no report was made by the committee until the following November, at which time a report was presented recommending that the relief asked for be granted, provided it should appear to the Finance Committee that the state of the funds would justify the consequent increase of expenditure. The recommendation of this committee was consequently referred to the Committee on Salaries, and in December following a resolution was reported and adopted authorizing the appointment of an additional Fellow to give instruction in the Department of Philosophy, Ethics, and Psychology, and to hold office from the first day of July, 1886, at an annual salary of \$500.

Unfortunately, this provision by no means meets

the exigency. What the professor asked for, and what he needed for the thorough discharge of all the duties imposed upon his chair, was a person qualified to assume the entire responsibility for some one or more of the complete subjects entrusted to his department. This is a thing not to be expected from a juvenile and inexperienced Fellow ; while a scholar of more maturity and one adequately qualified for such a charge could not be expected to serve for the meagre compensation of five hundred dollars per annum. Moreover, the relief offered was postponed to the distant future, when the need was immediate and urgent. By a fortuitous concurrence of events, however, it has been made possible to provide satisfactorily for the wants of the present year. Mr. Nicholas Murray Butler, Ph.D., a graduate of the College of 1882, distinguished before graduation for unusual proficiency in philosophic studies, and ever since indefatigably occupied in the prosecution of similar studies, who had also heretofore been a voluntary assistant in the Department of Philosophy, tendered his services to meet the classes in that department when, during the early part of the first session, the precarious health of the professor interfered with the regularity of his attendance ; and when later the professor was obliged to ask from the Trustees a leave of absence of some duration, he was charged by the President, by authority of the Trustees, with all the work of the department in the School of Arts, embracing both graduate and undergraduate instruction. Mr. Butler has thrown himself into the work with great zeal, and has done much more than the strict requirements of duty would have

demand. In addition to the hours assigned in the programme to the professor with the undergraduates, he has maintained two classes of volunteers in Ethics, one of Juniors and the other of Seniors, giving to each two lectures weekly. And with graduate students he has delivered two courses of lectures occupying four hours per week, although the number of students applying for this instruction was not in either case sufficient, under the rules, to make the holding of the course imperative. All this work, more than twice what is prescribed to the department in the official scheme, has been done in an entirely satisfactory manner ; so that the absence of the professor has not operated prejudicially to the interests of the students.

In regard to the future, the prospect is less satisfactory. We have reason to expect that the professor will be at his post on the first of October next ; but it is hardly probable that he will avail himself of the permission granted him of nominating a Fellow to assist him in the business of his department ; for the reason that the assistance thus conceded is not of the kind to meet the exigency. Five distinct subjects are assigned to this department, viz., Logic, Ethics, Psychology, the History of Philosophy, and Philosophical Theories of Government. Each of these is sufficient to give occupation to one man, especially in an institution which proposes to provide for the instruction of graduates as well as of undergraduates. The History of Philosophy, indeed, might alone furnish material for a number of professors, and some of our sister universities are making provision accordingly. In the progress of time Co-

lumbia College will probably do the same, but her urgent present need is provision for one only of the subjects above named which, though of paramount importance in the education of the young, has for a number of years been totally neglected with us. This subject is Ethics, or the philosophic theories of right and wrong, a subject as to which just ideas are of more value to the individual man than he can gather from all the remaining subjects associated with it in this department—Logic, Philosophy, Mental Science, and Philosophical Jurisprudence put together.

The professor, ever since his election, has given his nearly exclusive attention to Philosophy and Psychology, and has made no attempt to give instruction in Ethics. He explains the omission by representing that to carry on so many branches of instruction at the same time is unreasonably to overtask his strength. It is indeed certain that to multiply the number of topics intrusted to a teacher is to incur the danger of degrading the quality of his teachings in all of them. On this account it is greatly to be desired that there should be appointed an assistant in this department possessing such familiarity with the principles of moral philosophy, and such experience in imparting knowledge to young men, as to repair the serious defect at present existing in our scheme of instruction in this department. The gentleman who has been in charge of the department *ad interim* since December last has proved himself to be possessed in an eminent degree of the qualities necessary to fulfil the duties of such a position satisfactorily, and the undersigned most earnestly recommends that the appointment asked for be conferred upon him.

*Fellows as Assistants.*—It is impossible, in any school or college, to verify to what extent learners are faithful in their work, and how thoroughly they become possessed of the knowledge which it is their duty to acquire, without holding them to account by means of frequent and searching examinations. Such examinations, commonly called recitations, form accordingly an important part of the business of every college officer engaged in instruction. Long continued and universal usage have fixed the duration of such exercises at one hour each. Experience has furthermore shown that, within the limited period of one hour, it is impossible to make a satisfactory test of the thoroughness with which the student has accomplished his prescribed task in more than about a dozen individual cases. Yet it is no uncommon thing in a college for an instructor to be obliged to hold recitations with classes or sections embracing thirty or forty students each. In case he has so many as three to five hours allotted to him with these, weekly (which is rarely the case), he may be able to hold each individual student to account about once a week ; if he has but one hour weekly, once a month. The results of examinations so rarely held can form but a narrow basis of evidence on which to enable a teacher to form a judgment of the proficiency of a student. And the same infrequency offers a dangerous temptation to the student to neglect his work or to perform it in only a perfunctory way. For he is aware that there are always three or four chances to one against his being called up, and when that accident has really happened to him, he feels quite secure against its recurrence for several successive exercises next following.



There are two expedients by means of which it is possible to guard against the prejudicial consequences of a state of things like this. The first is that which is practised in the military and naval schools of the government, to divide the classes into squads embracing each not more than ten or twelve individuals, so as to insure the certainty that every one will be held to account at every meeting ; and the other is, to prepare questions to which every individual, whatever the number in the class may be, shall be required to return written answers on the spot. Either of these expedients exacts, as a condition of its possibility, an increase in the strength of the staff of instruction ; the first, because each squad must have its own examiner ; and the second, because the examination of thirty or forty written papers after each hour of class instruction, involves a labor of a magnitude and kind too heavy to be reasonably imposed upon the head of a department, and which cannot be so imposed without seriously interfering with his higher usefulness.

It is a wise policy, therefore, to provide the professor with one or more young assistants, competent to hold oral examinations of small sections, or to pass upon the quality of written performances prepared under the direction of the chief. It is this policy which has been under experiment in our College for the past several years, with results constantly and increasingly satisfactory.

Moreover while thus greatly adding to the efficiency of our system of instruction, we have been enabled by the same means to afford to a number of promising young men desirous of prosecuting studies

in various departments of letters and science beyond the limits of the undergraduate course, the opportunity to continue their connection with the College in the Graduate Department, and thus to qualify themselves for pursuing a literary, scholastic, or scientific career, which may be creditable both to them and to the College. There are among our graduates every year a number who are only deterred from the prosecution of advanced studies for two or three additional years, by the consideration of expense. For these the stipend attached to the Fellowship, though modest, is sufficient to remove the difficulty; and it is always possible, therefore, to fill the places of those who retire, from the ranks of new candidates, who are moreover usually among the choice scholars of their several classes.

The question is sometimes asked whether it is possible that young men recently from the ranks of undergraduates in college can be properly qualified to figure as teachers of others only two or three years behind them in age and scholastic experience. The reply is that, in some respects, they are better qualified for this duty than even the learned and mature men who stand at the head of the several departments. For the very reason that they are of recent emergence from undergraduate life, they can place themselves more nearly at the standpoint of the student, can see more clearly the nature of his difficulties, and show him with better effect how to surmount them. This point is very happily presented by the Faculty of Yale College in a report on the course of instruction in that institution made nearly fifty years ago. "There is wanted, on the one

hand," say the reporters, "the experience of those who have been long resident at the institution, and on the other, the fresh and minute information of those who, having more recently mingled with the students, have a distinct recollection of their peculiar feelings, prejudices, and habits of thinking. At the head of each great division of science, it is necessary that there should be a professor, to superintend the department, to arrange the plan of instruction, to regulate the mode of conducting it, and to teach the more important and difficult parts of the subject. But students in a college who have just entered on the first elements of science, are not principally occupied with the more abstruse and disputable points. Their attention ought not to be solely or mainly directed to the latest discoveries. They have first to learn the principles which have been in a course of investigation through successive ages and have now become simplified and settled. Before arriving at regions hitherto unexplored they must pass over the intervening cultivated ground. The professor at the head of a department, may therefore, be greatly aided, in some parts of the course of instruction, by those who are not so deeply versed as himself, in all the intricacies of the science. Indeed, we doubt whether elementary principles are always taught to the best advantage by those whose researches have carried them so far beyond these simpler truths that they come back to them with reluctance and distaste. Would Sir Isaac Newton have excelled all others of his day in teaching the common rules of Arithmetic? Young men have often the most ardor in communicating familiar principles, and in removing those lighter

difficulties of the pupil which, not long since, were found lying across their own path." No argument could apparently be more convincing in favor of the system which we have recently adopted there.

*Prize Fellowships and Scholarships.*—By resolutions of the trustees adopted April 3, 1871, there were established two prize Fellowships of the value of five hundred dollars per annum each, to be awarded to the most meritorious students in the graduating class of each year, in letters and science, as ascertained by competitive examination, and to be held for the term of three years from the date of appointment. At the same time were established twelve prize scholarships, later increased to fourteen, of the value of one hundred dollars each, to be awarded to the most meritorious undergraduate students, for superior proficiency in different branches of study, also to be ascertained by competitive examination. Under these resolutions there have been appointed up to the present time, nineteen prize Fellows, the awards in some years having failed, either from the non-appearance of candidates or from the unsatisfactory performances of competitors; but in the cases in which appointments have been made, the subsequent career of the Fellows appointed has been such as to justify in an eminent degree the wisdom of the policy. In the year 1883, the Faculty of the College, for reasons then assigned, petitioned the Trustees to discontinue the practice of awarding these Fellowships by competitive examination, and to authorize nominations to the same to be made directly by the Faculty themselves, subject to confirmation by the Trustees. To this proposition the Trustees acceded.

In the meantime the prize scholarships have continued to be awarded to undergraduates by competitive examination as before. It appears now, at length, that this system does not work advantageously. It was designed and hoped that it might prove a stimulus to emulation and so to elevate the general standard of attainment in all branches of study in the College. This anticipation has not been realized; and the manner in which the legitimate operation of the proposed test has been practically neutralized, though easy of explanation, need not be enlarged upon here. The subject is mentioned for the purpose of recommending an inquiry by a committee of the trustees as to the expediency of discontinuing the award of prize scholarships according to the present method, and of adopting some plan for the application of the sum now annually devoted to that purpose in some way more likely to be effectual in accomplishing the objects aimed at in this appropriation.

*The Graduate Department.*—The history of Columbia College naturally divides itself into three distinct periods, characterized severally by the extent of the educational operations carried on during their continuance. The first, which was much the most extended in duration, occupied about a century after the foundation of the College in 1754. The course of instruction during this period was confined mainly to the studies called *par eminence* disciplinary, viz. : Latin, Greek, and the Pure Mathematics. The only subject additional to these which was continuously provided for from the beginning was Moral Philosophy. The elements of the Physics and Chemistry

were taught to a limited extent, and a little Natural History was embraced in the prospectus, but was taught hardly more than in name.

It is true that, very early in the history of the College, there was opened by the corporation a School of Medicine, which was also revived after the Revolution and maintained a feeble existence down to 1810; but the total number of its graduates was not so much as one annually, although it must be recorded to its credit, that the name of one of these was Valentine Mott. A chair of Law was also created near the close of the last century, which was filled by a very eminent man, but the School of Law which began with him ended with him also. Notwithstanding, however, these occasional, and on the whole abortive, attempts to enlarge the scope of its educational operations during this centurial period, the institution remained practically, throughout its continuance, in the strictest sense a School of the Liberal Arts. This may therefore be distinguished as its *gymnasial* period.

The dawn of the second period in this history appeared in 1855, in the adoption of a resolution to appoint a committee to inquire into the actual condition and the past history of the scheme of instruction in the College, and to report such measures as might seem to them to be best adapted to increase its efficiency. The committee appointed under this resolution went into a very wide range of inquiry, involving an examination of all the professors in the College, and answers to written questions addressed to eminent educators all over the Union, the body of evidence thus gathered having been published after-

wards in a volume of 750 pages. The result was the adoption, in addition to the academic course, which was to be maintained as heretofore, of a scheme embracing a number of so-called university courses, to be conducted in some instances by non-resident professors, or professors belonging to other institutions. The scheme as a whole was too advanced for the popular appreciation, and it hence proved educationally and financially a failure ; but one outgrowth of it survived, and achieved a signal success, of which we have an enduring and visible evidence to-day in the existence and celebrity of our present Law School. With the opening of this Law School, in 1858, commenced the second era in the history of our College, which may be called the period of Professional Schools. Two years after the commencement of operations in the Law School, negotiations were opened with the College of Physicians and Surgeons, the institution which, early in the century, had supplanted and practically extinguished the original Medical School of Columbia College, by which that institution became, for educational purposes, a branch of the College, an alliance which continues to exist. In 1864 the doors were first opened of the Columbia College School of Mines, of which, as the name implies, the original intent was to prepare a class of men to meet a demand then beginning to be lively, competent to direct the great mining industries of the interior and the western coast of this continent. The success of this school led early to an enlargement of the plan of its operations, and this tendency to expansion has continued to produce its effect until, from a single school, the School of Mines has developed to

a cluster of seven schools, embracing Mining Engineering, Civil Engineering, Metallurgy, Practical Geology, Analytic and Applied Chemistry, Architecture, and Sanitary Engineering.

The third era in the history of our College, as yet the briefest of all, but destined to impress its distinctive character upon all future years, may be styled the period of University instruction. This dates only from the year 1880. In that year it was first publicly announced that advanced instruction would be given in a large variety of subjects of knowledge, embracing the Classics, the Mathematics, Astronomy, Chemistry, Geology, Mineralogy, History and Political Science, Philosophy, the English language and literature, and the language and literature of French, German, Spanish, and Italian. In the same year was established the School of Political Science, which, though having some affinities with the School of Law, is not a professional school. Its subjects belong rather to what, in a German university, is known as the Philosophical Faculty, by which is meant, in that country, the Faculty which teaches all subjects non-professional. The subjects taught in the first year of the School of Political Science are all of them to be found among the electives of the Senior year in the undergraduate department. Those of the remainder of the course in this school may properly be classed among the studies of the graduate department.

The Graduate Department, although destined doubtless, in coming years, to overshadow all the rest, is not expected to be of rapid growth. In its first year it numbered but six students. The number for the current (its sixth) year is twenty. Its steady



growth in the future may be confidently predicted from the fact that, in each succeeding graduating class, there is an every year increasing number of individuals who express a desire to go on to higher attainments, although all do not actually persevere, for the lack of means ; and further, for the reason that there are, at this moment, and there have been at any time for many years past, some hundreds of graduates of American colleges pursuing studies in German universities, for the reason that they have imagined that equal advantages could not be found nearer home. In past years it has seemed to be an impression almost universally prevailing among the young men graduating from American colleges with aspirations for making a career in a learned or scientific profession, or in the educational field, that a residence of one or more years at a German university was indispensable to any thing like signal success. Among the instructors of our own College, for example, there are no fewer than nineteen who have had that experience. But with the large opportunities now offered on this side of the Atlantic, at such institutions, for example, as Harvard University, Yale College, the College of New Jersey, Johns Hopkins University, and Columbia College, this false impression is destined soon to disappear ; and though, for some particular purposes, there will long be an advantage in study abroad, this will not be the case for that principal class of graduate students whose aim is to improve themselves in literary, historical, or philological studies, or the exact sciences. This is apparent from the increasing numbers of resident graduates whose names we see recorded in the annual catalogues

of some of the institutions above named. Thus we find twenty-three at the University of Michigan, forty-one at Yale College, fifty-eight at Princeton, and sixty-four at Harvard University. Our own number this year is but twenty, but the colleges above named had no more so soon after these graduate courses were opened.

At our School of Mines there have been graduates in small numbers studying for higher degrees ever since its foundation. In that school the liberal policy was adopted immediately after the graduation of its first class, of allowing graduates to receive instruction in the school free of charge for tuition. This policy had the advantageous effect of inducing many of the most gifted of our graduates to devote sufficient time to study before going into the actual practice of a laborious profession, to perfect themselves in the sciences, and so to assure to themselves higher success in life and to their school a more honorable reputation in the world. When, in 1880, the Graduate Department was opened, and a tariff of tuition fees was announced to be paid by students who might attend it, it was felt that consistency required that the graduates of the School of Mines should be subjected to the same rules as to this matter as those of the School of Arts. Hence the resolution was rescinded which granted free tuition to the former class of graduates.

It is the view of the undersigned, partly formed, it is admitted, in the light of experience, that it would have been more advisable to have secured the desired consistency rather by making tuition free to graduates of the School of Arts than by abolishing the privilege

of free tuition which for the fifteen years preceding had been enjoyed by those of the School of Mines, without prejudice to any one and to their own great advantage. For the opening of the Graduate Department has not involved any additional expense to the corporation, not even so much as a single dollar. And as the growth of this department is certain to enhance so largely the reputation enjoyed by the College as an educational institution of a high order, it is quite worth while to forego the small amount which the tuition fees which these students will add to the general revenues of the College, at least till such time as the throng shall be so great as to give to this question an importance which it is far from possessing to-day. The undersigned, therefore, respectfully recommends that, henceforth and until further order, tuition shall be given to all graduates of this College, in any of its Schools, entirely free of charge.

*Free Public Lectures.*—For several years past there have been given at the College evening lectures, weekly or more frequently during a great part of the academic year, to which citizens in limited numbers have been invited, and which have been generally well attended. The lecturers have been professors of the College or School of Mines, or members of some of the scientific associations connected with the institution, or gentlemen of distinction invited by them. These have not been publicly announced, because the lecture-rooms in which they have been held have not had sufficient seating capacity to accommodate a large audience.

More recently, however, the lecture-rooms of the

Law School, which will hold about three hundred persons each without crowding, and perhaps a hundred more by introducing movable seats and taking advantage of standing room, have been made available for a series of lectures given by day at a convenient hour on Saturday mornings, and notice has been given of them in advance in the papers of the day, but without any effort to draw public attention by advertising displays. To guard against overcrowding, it was thought advisable to issue tickets of admission, and the precaution proved a wise one; for applications for such tickets were received in numbers two or three times in excess of the accommodations, and the interest rather increased than diminished during the progress of the course. The first six lectures were by Prof. Boyesen, on modern foreign literature, including sketches of the works of contemporaneous writers of France, Germany, Scandinavia, and Russia, and not only of the works, but of the writers themselves, with most of whom the lecturer has had the advantage of being personally acquainted. The subject of the lecturer who succeeded Prof. Boyesen—Dr. Nicholas Murray Butler—was one which, though of great philosophical and practical interest, was supposed to be likely to attract rather the thoughtful few than the curious many; it was “*Pædagogy*; or, the Science of Education.” The result was, however, very different and very singularly so; for the demand for tickets rose in a few days to the extraordinary number of two thousand. After the first of these lectures had been given, moreover, letters to the number of two hundred were received by the lecturer, asking information as to the bibliography of the subject and instructions for reading. In the physical

impossibility of replying to all these inquirers in writing, Dr. Butler prepared lists of the books on the subject most easily to be procured and distributed them among the audience at the lecture next following. It was the design that this course of lectures should extend like the preceding to six in number, but the near approach of the final examination caused a postponement of the continuation until after the resumption of exercises in the autumn.

Large numbers of the gentlemen and ladies who were present at all these literary entertainments expressed very warmly their hope that they might be made a permanent part of our plan of educational operations, regarding them as not only a valuable means of diffusing knowledge among the people as well as among the students, but also as certain to increase in an eminent degree the interest taken in the institution itself and the appreciation of its usefulness by the surrounding community. There would be no difficulty in finding among the members of our several Faculties lecturers enough to keep up these exercises throughout the year. But if this is attempted, as it is greatly to be desired it should be, there would be a difficulty in meeting the reasonable expectations of the public for want of a hall of sufficient dimensions to receive the audiences which these interesting literary exercises would attract. Perhaps such a hall might be provided by the removal of the partition-wall which divides at present the two large lecture-rooms of the Law School and replacing it by some kind of sliding or folding doors. Should this be found impracticable, there would still remain the possibility of using some one of the large assembly halls in the lower part of the

city, though the adoption of that expedient would entail an annual expense of some two or three thousand dollars. An offset to that expense might of course be secured by charging an admission fee, but this would give a mercenary character to the undertaking which it is desirable to avoid. During the progress of the recent experiment, it has been a subject of pride to all connected with the College that we have been making a free contribution to the entertainment and the instruction of the public, and that our efforts have been so largely and so gratifyingly appreciated.

*The Library.*—The report of the Chief Librarian hereunto annexed shows the present condition of the library, and states in such detail the nature and the amount of the work accomplished in it during the year as to make it unnecessary to do more in this place than to refer to it. The evidence continues to accumulate of the steadily increasing usefulness of the library as an auxiliary to every department of instruction in the College or in its associated schools. The total number of books upon the shelves is at present over seventy-one thousand, which will be increased to about eighty thousand on the receipt of the books of the New York Academy of Science, offered and accepted as a permanent deposit during the last year, but as yet not delivered. They will be received some time in August next.

A valuable addition to the library has been made during the past year by the deposit here of the colossal and unique compilation of documents relating to the great Civil War, made by Mr. Thomas S. Townsend, and known as "Townsend's Rebellion Record." In this are embraced excerpts from the leading journals of New York and other principal cities of the Union, com-

prehending every article, small or great, relating to the war, its causes, its history, or its consequences, which has made its appearance through any of those channels from 1860 down to the present time, the whole filling nearly one hundred ponderous folio volumes. In a descriptive notice of this work it is said that "The Record comprises every thing—not merely down to the end of the battle-fields, but to the close of the equally important strife connected with the reorganization of the Union by the readmission of the several States in 1870, and it also includes whatever relates to matters connected with the decade ending 1870 that has appeared up to 1876." For 1876 we now read 1886. In order that this vast mass of heterogeneous material may be reduced to manageable shape, its contents have been systematized and condensed into an independent work bearing the same relation to the Record which a merchant's ledger bears to his day-book, but which the compiler calls his *Encyclopædia*. Of this it is remarked in the critical notice above mentioned, that "Every event of the struggle however minute, every fact, statement, assertion, or opinion in a speech, letter, report, or editorial, is separately entered from the Record, with references to volume, page, and column of the Record where they may be found." The *Encyclopædia* extends to twenty-five gigantic folio volumes of twelve hundred pages each. Finally an index is provided to the *Encyclopædia*, in one volume, which, as was remarked by the late Dr. Cogswell of the Astor Library, "renders the entire work as easy to be consulted as if it were compressed in a single volume."

This extraordinary work was deposited in our library by the compiler for a definite period of six

years, and for an indefinite period thereafter, unless a sum should be offered for its purchase which the compiler may be willing to accept, in which case, however, Columbia College shall have a right of pre-emption. This valuable accession to our library has been secured through the efforts of the Hon. Seth Low, one of our trustees.

The library has been indebted during the year to the liberality of some of its friends among our fellow-citizens for some valuable gifts. From Mr. J. F. Loubat has been received a donation of books to the value of about twenty-five thousand dollars. From A. A. Low, Esq., of Brooklyn, a generous gift of five thousand dollars came very opportunely at a moment when our book-fund was exhausted and a heavy list of urgent requisitions was in the hands of the Library Committee which they were without means to meet. Other gifts of less amount have been from time to time received, and, in a few instances, single volumes, or packages of several volumes of value, have been handed in by visiting friends.

A few weeks since the trustees ordered the publication and distribution of a printed appeal, addressed to the alumni and friends of the College, and to the citizens generally, asking for aid in filling up the defects of the library. Sufficient time has not yet elapsed to enable us to judge how far this appeal has been successful, but it has been commented on very favorably by the press, and expressions of individual opinion in many quarters justify the expectation that it may elicit an ultimately satisfactory, though it may be a somewhat tardy, response.

In the spring of 1884, it was publicly announced



that there would be opened, not earlier than the fall of 1886, a school for training young persons to the librarian's profession. The notice has attracted some attention, and has awakened considerable interest. Inquiries have been received in regard to it from many quarters, and a number of persons have expressed their desire or intention to avail themselves of its advantages. The enterprise is without precedent, and must, for the present, be regarded as an experiment, but there seems to be here a promising field for rendering to the public a substantially useful service. New libraries are coming into existence every day, and their value to the communities in which they are established will depend largely upon the competency of those who are charged with their administration. Heretofore it has been too commonly the case that libraries both new and old have been placed in the hands of persons wholly inexperienced, who have been left to educate themselves in a hap-hazard sort of way, and in many cases have not sought to be educated at all. A librarian who is a mere jailer of books can be of little service to those who use his books, and who often desire to learn something of the bibliography of a subject, as well as to obtain a particular volume. But hitherto the majority of librarians, unless those in large towns or large institutions of learning are excepted, have been capable of fulfilling their functions only in a purely mechanical way. It is hoped that our school may be the means of initiating a material improvement in the quality of this very necessary and important class of public servants.

## THE ASSOCIATED SCHOOLS.

*The School of Law.*—Nothing has occurred to interrupt the regularity of the exercises in the Law School, which have proceeded during the year in a manner entirely satisfactory both to instructors and to students. The school has had this year for the first time the entire benefit designed to be secured to it by the resolutions of 1882 providing for the appointment of three Prize Tutors, one in each succeeding year, and all to serve for a period of three years as assistants to the professors in a variety of ways, but principally as daily examiners of the classes on the subjects taught in the lectures. Though the attendance on these examinations is not compulsory it has been general and regular, and it is stated by the Warden in his report that the results have more than justified his anticipations in recommending the adoption of the system.

If only for the sake of consistency, the undersigned feels bound once more to call attention to the fact that our school is at a disadvantage as compared with others in connection with sister institutions, in offering to its students no opportunity to proceed to a degree higher than that of Bachelor of Laws. This disadvantage admits of so easy removal that its continuance cannot but be subject of great regret to the friends of the school. The decline in the attendance during the past several years cannot but be in a measure owing to this circumstance. It is known that no very small number of our recent graduates would have very gladly availed themselves of the opportunity of a third year of instruction had it been offered to them, and it is quite natural that the class of young men who look upon law as a science

to be studied for its inherent interest rather than as a craft by which to secure emolument, should be attracted to a school which holds out the largest possibilities of attainment rather than to one which limits itself to the work of making mere practitioners.

The extension of the course to an additional year is further recommended by the fact that such an extension involves no new appointments and no additional expense; while by increasing the attendance it is certain to secure a material increase of revenue.

*The School of Political Science.*—Each succeeding year brings with it new evidence of the great value of this recently established branch of our university system. The character of the dissertations presented by the graduates of the school in fulfilment of the conditions required for the attainment of the doctorate in Philosophy, has been such as to furnish proof not only of extensive and faithful study, but also of well-formed habits of systematic investigation, and frequently of creditable originality of thought. The interest taken by the public in this part of our work has also manifested itself in a variety of ways, and especially in a disposition to lend it substantial aid; as one example of which may be mentioned the endowment of four Fellowships in the school, of the value of two hundred and fifty dollars each, to be maintained for the next five years, by Jesse Seligman, Esq., of this city; and as another, the establishment for the same length of time of a prize of the value of one hundred and fifty dollars, to be annually awarded to the author of the best essay upon some topic in Political Economy, by Edwin R. A. Seligman, Esq., Ph.D., a graduate of the school.

The character of the instruction given in the school, and of its power to stimulate intellectual activity has been recently brought forcibly to the attention of the public, by the issue of a quarterly periodical devoted to discussions in Political Science, under the editorship of the Faculty of the school ; and it is a gratifying evidence of the general interest taken in these discussions, that the financial success of this undertaking, as is stated by the publishers, is already assured, before the publication of the second number.

The Academy of Political Science, an association referred to in the last annual report of the undersigned as established in connection with the school, continues to be maintained with undiminished zeal, and is accomplishing a very useful work.

*The School of Mines.*—The most important step of progress taken in the scheme of instruction in the School of Mines during the present year, has been the institution of a systematic course for the education of sanitary engineers. The lecture course on hygiene heretofore given by Dr. J. S. Billings, Assistant Surgeon-General of the United States, has been largely extended, and strengthened by appropriations for the purchase of models, drawings, and apparatus ; and a laboratory has been opened for instruction in Microscopy and Micro-Biology. These provisions have excited general interest, and many students in the courses of Chemistry, Civil Engineering, and Architecture have attended the lectures, without proposing to become sanitary engineers by profession. The microscopic laboratory has been frequented to its full capacity, and it is desirable that it should be greatly enlarged whenever the time shall arrive for the com-

pletion of the plan of building upon this block contemplated by the trustees.

*Summer Schools.*—The usual summer schools in Practical Mining, in Surveying, in Mechanical Engineering, and in Geodesy, were held during the long vacation of 1885, for particulars respecting which, reference is made to the reports of the professors directing these operations, hereunto appended. It is a source of gratification that the young men composing these schools are so cordially received by the proprietors of the works visited by them, who even occasionally supplement their good offices by good advice and even by assisting to some extent in the business of instruction. The class in Practical Mining divided their time between the iron mines of northern New Jersey and the coal region of northeastern Pennsylvania. The professor was assisted by voluntary aids, appointed under a resolution of the trustees of June 2, 1884, who were, this year, Messrs. Edward R. Bush, James F. Kemp, and Robert V. A. Norris, all engineers of mines and graduates of the school. The number of the class was somewhat smaller than in former years, being only twenty. This diminution in number was owing in part to a rule of the Faculty which prohibits students in any manner deficient in their past studies from becoming members of it. The exclusion may seem harsh, but there is no doubt that the effect of the rule on the general standard of scholarship is beneficial. Excessive numbers in the field, moreover, are disadvantageous in the practical work in which the class is engaged.

*The Summer School in Surveying.*—This was held in the vicinity of the pleasant country town of Litchfield,

Connecticut. The class was inconveniently large, numbering forty-seven in all. The professor was assisted by Messrs. R. V. A. Norris, who was also an assistant in the class of Practical Mining, Henry D. Conant, and John H. Janeway, Jr., the former two being graduates of the school, and the last a member of the graduating class of 1886. The operations of the class were successful and profitable, but were momentarily disturbed by an incident fully recounted in the appended report of the professor, which happily terminated in a manner entirely honorable to the class.

*The School of Mechanical Engineering.*—This school has been conducted this year according to the methods heretofore described, the meetings and studies being held in this city. It has been found necessary to limit the number of students attending, the number of applicants for admission exceeding that which it is possible for a single professor to handle. The apprehension was last year expressed that it might be necessary to abandon this annual and very valuable course of practical instruction (which is entirely voluntary on the part of the professor, and not imposed by authority of the trustees) on account of possible interference with the Summer School in Surveying, which is compulsory for the same class of students; but experience has proved this apprehension to be unfounded, and the school will probably continue to be maintained in the future as in the past, without interruption.

*The Summer School in Geodesy.*—The report on the operations of this school, which will be found in the appendix, gives a succinct, but very interesting account of the work done. The earlier portion of the

time occupied was devoted to instruction and practice in the use of instruments at the observatory, after which the trigonometrical survey of Otsego Lake, on which the class has been engaged in preceding years, was resumed and completed. Appended to the report of the professor are letters from J. T. Gardner, Esq., Director of the State Survey, and of his assistant, Horace Andrews, Esq., who had been requested by Professor Rees to make an examination of the work executed by the class heretofore, which letters furnish a very flattering testimony to the scientific skill with which these operations have been conducted, and to the accuracy of the results obtained.

*The School of Medicine.*—The condition of this school was never more flourishing than at present, nor its prospects more encouraging. The crowded state of its halls attests the high appreciation in which it is held by the community, and especially by the medical profession. The disadvantages under which it has for many years labored, from the inadequacy of its accommodations, will very soon be removed by the construction of the new college building provided for by the liberality of the late William H. Vanderbilt, Esq., of which the corner-stone was laid a few days ago, on a very favorable site, immediately opposite the Roosevelt Hospital, and which will be flanked by the Maternity Hospital and the Free Clinic about to be erected by the children of the same benefactor, on whom the generous spirit of their large-hearted father seems to have descended. These important contributions to the advancement of medical education in this city will go far toward making New York what it was the hope of those with whom they originated to make it—the

centre and chief fountain-head of medical science on the western continent.

*Conclusion.*—In concluding this, his twenty-second annual report, the undersigned desires to express to the Board his grateful sense of the kind and indulgent support by which they have sustained him from the beginning, and which has given to his administration whatever of success may have attended it ; and to the Supreme Ruler of all things for the strength which has been vouchsafed him to bear up under his many and weighty responsibilities, and for the blessing, often far above his deserts, which has in so many instances crowned his endeavors to discharge his duty.

All which is respectfully submitted.

F. A. P. BARNARD,  
*President.*

Columbia College, May 3, 1886.



## APPENDICES.



**APPENDIX A.**

**REPORTS ON THE COURSE OF INSTRUCTION IN THE SCHOOL OF ARTS.**

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DEPARTMENT OF GREEK.

*To the President of Columbia College :*

*The Senior Class*—Greek Section—has attended the Jay Professor of Greek two hours a week throughout the year, and has read the *Seven against Thebes* of Æschylus, with explanations from the Professor on the subject-matter and form of the play, and with remarks on the Greek drama and dramatic representations.

The class has read also portions of the Oration of Demosthenes on the Crown, with constant reference to the history of the times, and explanations of the legal terms and usages.

A section of this class has attended in addition one hour a week through the year and has read the Olympic and part of the Pythian Odes of Pindar.

*The Junior Class*, divided into two sections, has attended the Jay Professor of Greek two hours a week throughout the year, and has read the *Antigone* of Sophocles, with explanations of the grammatical and archæological matters of interest connected with the play; and also half of the *Protagoras* of Plato, with a careful analysis of the dialogue and discussions on the life and teaching of Socrates.

A section of this class has elected Greek, in addition, for one hour a week, and has read the *Apology* of Socrates from Plato.

*The Sophomore Class*, divided into three sections, has attended the Adjunct Professor of Greek three hours a week throughout the year, and has read the *Iphigenia in Tauris* of Euripides, with the usual attention to metres and scansion; and also the Sicilian Expedition (from the sixth and seventh books) of Thucydides; to accomplish this it has been necessary to omit the exercises in composition and reading at sight.

*The Freshman Class*, divided into four sections, has attended the Tutor in Greek three hours a week throughout the year, and has read the sixth and seventh books and part of the eighth book of the *Odyssey*; and also the greater part of the seventh book of Herodotus.

Weekly exercises in Greek grammar and composition have been continued through the year. To render this work more efficient and to give a larger share of personal instruction to members of the class, the Adjunct Professor has taken two sections on different days, and the Tutor in Greek the other two in the same way, thus practically doubling the time given to these exercises.

A volunteer class in reading at sight has attended the Adjunct Professor of Greek two hours a week, and has read the first four books and parts of the fifth and sixth of Xenophon's *Hellenica*, and, in addition, the *Acharnians* of Aristophanes.

There have been two graduate classes attending the Jay Professor during the year. The more advanced class has read carefully four and a half books of the *Ethics* of Aristotle. The first-year class has read the Olympic and Pythian Odes of Pindar, with study of the Doric and Æolic dialects; and, in addition, the *Agamemnon* of Æschylus.

Respectfully submitted,

H. DRISLER,

*Jay Professor of Greek.*

Columbia College, May 30, 1886.

## DEPARTMENT OF LATIN.

*To the President of Columbia College :*

*The Post-Graduates.*—There have been three students of this class during the past year attending me two hours a week. The author studied was Tibullus. During the first term the instruction was given wholly by lectures. The first book was translated, and then commented on in respect to grammar, antiquities, and questions of text. During the second term the second book was translated by the class and then commented on as before. The text employed was that of Lucian Mueller, with reference, on occasion, to the first Aldine, to Lachmann, and to Bachrens. When this was finished, lectures were given them on some difficult points of Comparative Etymology, and they had exercises in colloquial Latin after Terence. One of their number, Mr. Jackson, presents for the degree of Doctor in Philosophy an essay on the Style of Tibullus, which he has prepared with great fulness and care.

*The Senior Class.*—Latin is an optional study with this class, and was chosen by thirty-two of its members during the past year. During the first term they read the greater part of the *Captivi* of Plautus, with special attention to the archaic forms and syntax, and to the metres. During the second term they finished this play, and read twenty chapters of the first book of Cicero *de Natura Deorum*, in Schoemann's edition, with special attention to his style and to the philosophy of this work. They had a lecture on Roman Comedy, one having been given them on Roman Philosophy during the Junior year. An extra section of this class, numbering twelve, attended me one hour a week through the year, and more were desirous of attending, but were prevented by the difficulty of finding a common hour convenient for all. During the first term they read selections from the *Heroides* and the *Amores* of Ovid in the Clarendon Press series, 490 lines in all ; and in the second term they read 72 sections of the tenth book of Quintilian.

*The Junior Class.*—Latin is now a required study in this

class two hours a week. During the first term they read with me the first, third, fourth, and twelfth Satires of Juvenal, with special attention to his usages, and to the historical and other allusions. They also had exercises in writing Hexameters. During the second term they read twenty-seven chapters of the first book of Cicero's *Tusculanæ*, with special attention to the philosophy of the work. They had exercises in writing Latin prose, adapted from their reading. They also had lectures, the first term on Roman Satire, and the second on Roman Philosophy.

A third and optional hour has been granted them in this study, and twenty elected it. During the year they read through the *Adelphi* of Terence, consisting of 997 lines, with careful attention to his style, and with some exercises in metre.

*The Sophomore Class.*—This class is under the instruction of Dr. H. T. Peck, and read during the first term the first book of the Satires of Horace. Special attention was given to a review of the rules of Prosody, and to the etymology of words as bearing on their quantity. In the second term they read all of the first and fourth books of Livy that is contained in Lincoln's selections; and one hour a week was devoted to writing Latin Prose after the style of Livy. A lecture was given them on the Roman Historians and Roman History. Dr. Peck also had charge of the whole Freshman class in writing Latin during the first, and of one half the class during the second term.

*The Freshman Class.*—This class has been under the instruction of Dr. H. A. Short, and read during the first term the first book of the Odes of Horace, with selections from the second. Special attention was paid to the allusions, and to the syntax of the moods, and to the lyric metres of Horace. During the second term they read Cicero *de Senectute*, using Mr. Reid's edition in the Pitt Press series. The general usages of Cicero were pointed out, and the derivation and the composition of words were carefully treated. A lecture was given them on Roman Lyric Poetry and its connection with the Greek. During this term also one half the class

wrote Latin Prose with Dr. Short, taking the language of their text-book for a model.

*Volunteer Classes in Reading Latin.*—The members of the Sophomore class during the second term were occasionally practised in reading at sight in the fourth book of Livy, and the following students deserve special mention for proficiency in this exercise: Henry Augustus Sill, John Dyneley Prince, Clarence Hoffman Young, Frank Armitage Wilcox, Walter Hippeau Merriam, Arthur DeLancy Ayrault. Members of the Freshman class read one extra hour a week through the year from Pliny's Letters, and the following deserve special mention for their proficiency: James Robb, Thomas Worcester Thacher, Harry Custis Ager, Louis Ager, Mason Romeyn Strong, Victor Mellet Haughton.

Respectfully submitted,

CHARLES SHORT,

*Professor of Latin.*

Columbia College, May 22, 1886.

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DEPARTMENT OF MATHEMATICS AND  
ASTRONOMY.

*To the President of Columbia College:*

I have the honor to submit the following report of work done in my department during the current year:

SENIOR CLASS.

1. *Popular Astronomy.*—This course, which is purely elective, has been chosen by forty-two students, who have attended me twice a week throughout the year. A text-book has been used as a guide, but instruction has for the most part been given by lectures, with numerous lantern illustrations. The progress of the class, as determined by frequent examinations, both oral and written, has been satisfactory.

2. *Differential and Integral Calculus.*—This branch of

higher Mathematics was elected by eight students, all of whom have also attended the course of lectures on Popular Astronomy. They have used a text-book, and, in consequence of the small number in the class, their drill has been thorough and highly effective.

An experience of many years leads me to believe that not more than ten or twelve per cent. of our average college students are capable of doing good work in this difficult branch of study.

#### JUNIOR CLASS.

*Analytical Geometry and Mechanics.*—This course, which is elective, was chosen by twenty-nine students, of whom twenty-six are now on the roll. These students have attended me three hours a week throughout the year, studying Analytical Geometry the first term and Mechanics in the second term. A text-book is used in each branch, but a considerable share of the instruction comes from other sources. In Analytical Geometry the knowledge of the students is tested by many daily exercises prepared for the purpose. In Mechanics one day in each week has been devoted to lectures, illustrated by models and apparatus, with which the department is well supplied. The Schroeder models of mechanical combination and the Willis apparatus have played a prominent part in these illustrations, and their exhibition has served to excite and keep up a keen interest in the entire course.

The progress of the class has been satisfactory, but I am of the opinion that better work would be done if the course were chosen by a smaller number of students.

#### GRADUATE INSTRUCTION.

One member of last year's class has attended me once a week, continuing the study of higher Mathematics. He has also given a good deal of his time to Descriptive Geometry and its applications.

Another class of four students (all members of the class of 1885) commenced the study of higher Mechanics in Octo-



ber. One of these was obliged to leave on account of ill health, but the other three have attended me regularly throughout the year.

In my opinion the course of graduate instruction in Mathematics and Mathematical Sciences should be more thoroughly systematized, so that the studies should follow each other in logical order.

*Assistance.*—Mr. Stilwell, a Fellow of the College, has aided me with zeal and fidelity. He has read the papers that have sprung from the exercises in Analytical Geometry, already referred to, together with the numerous papers of the monthly and semi-annual examinations. He has aided me in my lantern illustrations and also in the preparation and exhibition of the experiments in Mechanics. The ability with which he has served the College seems worthy of special commendation.

Respectfully submitted,

WILLIAM G. PECK,

*Professor of Mathematics and Astronomy.*

Columbia College, May 30, 1886.

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#### DEPARTMENT OF MATHEMATICS.

*To the President of Columbia College :*

I have the honor to report that, during the past year, the Freshman and Sophomore classes have attended in mathematics as follows :

The Freshman class—four times in sections and once as a class, in all five times per week ;

The Sophomore class—once in sections and twice as a class, in all three times per week ;

and have accomplished the course of study as set forth in the Handbook of Information for the year.

The examinations for scholarships in mathematics, yet to

be held, will be upon the work of the year, with the addition, for the Sophomore class, of Chauvenet's Introduction to Modern Geometry, and, for the Freshman class, of extra work in the solution of higher equations and the construction of loci.

The Fellows assigned to the department as assistants have been of great service, particularly in examining and marking for comment the numerous written exercises required, and found necessary for the efficient instruction in mathematics, of the two lower classes.

During the year three Fellows of this College and one graduate of Wellesley College have pursued a course of higher mathematics in the Graduate Department.

Two of the Fellows, Messrs. Fiske and Stabler of the class of 1885, have, besides rendering assistance in the department, read the whole of Williamson's Integral Calculus and about one hundred pages of Forsyth's Differential Equations, and have passed satisfactory examinations thereupon. Toward the latter part of the year each of them delivered an excellent lecture, more than an hour in length—the one upon Roulettes and Pedal Curves, and the other upon Planimetry. I recommend them for the degree of Master of Arts.

Mr. Samuel E. Stilwell, of the Class of 1883, has been, for the past three years, studying here for the degree of Doctor of Philosophy. He has been a most faithful and meritorious student. His course in mathematics, which has been very thoroughly pursued, has been in Determinants (Muir), Quaternions (Hardy), Theory of Equations (Todhunter), Calculus of Variations (Carll), Differential Equations (Forsyth), Calculus of Finite Differences (Boole), with a great deal of other work which the satisfactory accomplishment of the above course implies. In addition he has read, with especial reference to his thesis upon the Catenary as the curve of lowest centre of gravity, Woodhouse's Isoperimetrical Problems, Todhunter's History of the Calculus of Variations, and the Adams Prize Essay on Discontinuous Solutions (Todhunter). He has embodied the

results of his study in a very carefully written, laborious, and creditable thesis. I recommend him for his degree.

The studies of Miss Winifred Edgerton, the graduate of Wellesley College alluded to, have been in mathematics and practical astronomy, in which latter, of course, she has not come under my supervision. In the preparation of her thesis, however, as one of the requirements for the degree of Doctor of Philosophy, for which she applies, I have had frequent occasion to advise with and examine her in mathematics. In my opinion, she has been very carefully and thoroughly instructed, is unusually proficient, and has exceptional ability. The title of her thesis is:

"Multiple Integrals: (a) Their Geometrical Interpretation in Cartesian Geometry, in Trilinears and Triplanars, in Tangentials, Quaternions, and in Modern Geometry; (b) Their Analytical Interpretation in the Theory of Equations, using Determinants, Invariants, and Covariants as instruments in the investigation"—

And is developed under the following heads:

"1. To define the symbols,

$$\int dx, \iint dx dy, \iiint dx dy dz,$$

in (a) Cartesian Geometry, (b) Triplanars, (c) Tangentials, (d) Poles and Polars, (e) Quaternions.

"2. To connect this definition with Determinants and Linear Transformations.

"3. To present a general formula of transformation which will enable one by a variation of conditions to pass from any system in Analytical Geometry to any other system.

"4. To extend the truths deduced for double and triple integrals to  $n$  integrals.

"5. To make a special application of these propositions to a conic of revolution, referred to each of the five reference systems here considered."

The thesis covers a wide range and is of great merit. It exhibits originality of treatment in the plan of unifying the different systems of analytical geometry, the presentation of trilinears and tangentials in space, the development of the equations of transformation from Cartesian

co-ordinates to triplanar and tangential co-ordinates, the application of quaternions as a reference system for multiple integrals by means of the equations of transformation, the geometrical interpretation of the formation of determinants, and the reduction of the equations of transformation to the simple formula,  $\rho = rk^i j^k k^l$ .

It gives me great pleasure to recommend her to the Board of Trustees for the degree of Doctor of Philosophy.

Very respectfully,

J. H. VAN AMRINGE,

*Professor of Mathematics.*

Columbia College, May 17, 1886.

## DEPARTMENT OF PHYSICS.

*To the President of Columbia College:*

The following is the report of the work done in my department in the School of Arts during the year:

*Junior Class.*—During the first term, the Junior class was engaged for two hours per week on the subject of heat, embracing: expansion of solids, liquids, and gases; mercurial and air thermometers; maximum and minimum thermometers; conduction of heat by solids, liquids, and gases; tension of vapors; high, and low-pressure steam-engines; radiant heat; latent heat of liquids and gases, etc.

During the second term, two hours per week, subjects being: specific heat; properties of magnets; terrestrial magnetism; magnetic attractions and repulsions; frictional electricity; theories of electricity; electrical attractions and repulsions; electrical induction; electrophorus; Holtz's machine; electrical spark, nature and duration of; Leyden jar; Lichtenberg's figures, etc.

Galvani's observations; Volta's experiments; Voltaic battery; constant batteries; Oersted's fundamental experiment; tangent compass; galvanometer; Ohm's law; thermal, luminous, chemical effects; decompositions of salts; electro-metallurgy; attractions and repulsions of currents by

currents; electromagnets; chemical telegraph; Morse's telegraph; ocean telegraph; induction by magnets; magneto-electrical apparatus; Ruhmkorff's coil; Gramme-machine; Wallace machine, etc.

*Senior Class.*—Was occupied three hours per week during the first term in studying the subject of light:

Transmission, velocity, and intensity of light; photometers; reflection of light; plane, concave, and convex mirrors; spherical aberration; refraction by plates and prisms; total reflection; dispersion by prisms; spectroscopy; chemical and solar lines; lines from fixed stars; lenses, convex and concave; achromatism; camera obscura; simple and compound microscopes; astronomical and terrestrial telescopes; the eye and vision, etc.

During the second term, three hours weekly upon the study of sound:

Nature of sound waves; velocity through gases, liquids, and solids; reflection of sound; refraction; interference; measurement of wave-lengths; measurement of number of vibrations; vibrations of strings; musical scale; vibrations of rods, plates, and bells; organ pipes; flute pipes; reed pipes; vibrations of tuning-fork determined with chronograph; Lissajous' experiment; resonance; human voice; the ear and audition; telephone; phonograph, etc.

*Elective Seniors.*—Were engaged during the first term two hours per week, as follows: Mechanical theory of heat; determination of the mechanical equivalent of heat; conversion of heat into work; application to steam-engines; indicator diagrams; elasticity of gases; isothermals of gas and steam; adiabatics; Carnot's engine; reversible engines, caloric engines and steam-engines compared; absolute temperature, kinetic theory of gases, etc.

Electrostatics: determination of the constants of a battery; measurement of resistances; Wheatstone bridge, etc.

During the second term, two hours per week, as follows:

Absolute units; C. G. S. system; practical electrical units; theory of dynamo-electrical machines; electric lighting; arc and incandescent systems, etc.

Undulatory theory of light; propagation of light by waves; reflection of light; refraction of light; Fresnel's experiments; Pouillet's experiments; Newton's rings explained by the undulatory theory; thin plates; double refraction in uniaxial and biaxial crystals; conical refraction; plane polarization; circular polarization; elliptical polarization; rotary polarization.

Respectfully submitted,

OGDEN N. ROOD,

*Professor of Physics.*

Columbia College, May 30, 1886.

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DEPARTMENT OF HISTORY AND POLITICAL  
SCIENCE.

*To the President of Columbia College:*

The Department of History and Political Science in the School of Arts would beg to report that the usual instruction prescribed by the statutes of the Trustees has been given during the present year.

Professor E. Munroe Smith has instructed the Sophomore class six hours per week during the first semester in German History. Mr. Goodnow has instructed the Sophomore class six hours per week during the second semester in French History.

Professor R. M. Smith has instructed the Junior class two hours per week during the first semester in English History, and the Senior class two hours per week during the entire year in the Constitutional History of England. The head of the department has instructed the Senior class four hours per week throughout the year in the Constitutional History of Germany, France, and the United States.

Respectfully submitted,

JOHN W. BURGESS,

*Professor of History and Political Science.*

Columbia College, May 30, 1886.

DEPARTMENT OF PHILOSOPHY, ETHICS, AND  
PSYCHOLOGY.

*To the President of Columbia College :*

I have the honor to report that during the past academic year the work of the department has been carried on as follows :

1. *Junior Class.*—The junior class has attended in two sections, one hour a week each, in Logic. Jevons's *Lessons in Logic* was the text-book used for the study of deductive logic, while the history of logic, the relation of logic to philosophy, modern logical theories, induction and scientific methods have furnished the subjects for a course of lectures that embraced something more than half the year. Four special students have also attended this course.

2. *Senior Class.*—An elective class of twenty-three seniors has received instruction by lecture three hours per week throughout the year. Two hours per week have been devoted to the history of philosophy from Thales to Cousin, Lotze and Spencer. The remaining hour per week has been occupied with Psychology, in which the instruction has been chiefly by lecture, Sully's *Outlines of Psychology* being used partly as text-book and partly as a book of reference. Among the special subjects treated of by lecture were the structure and functions of the brain and nervous system, the localization of brain functions, unconscious mental activity, and the outlines of psycho-physics.

3. *Graduate Department.*—In this department two courses have been given during the year, each attended by a single student. N. E. Crosby, A.B. (Columbia, 1885), has attended two hours per week for the study of the philosophy of Aristotle, preparatory to being examined for the degree of Master of Arts. This course was interrupted in March by Mr. Crosby's departure from the city. He expects to fulfil the requirements for the degree of A.M. at some future time.

W. H. Pott, A.M. (Columbia, 1885), has attended two hours weekly for the study and exposition of the philosophy

of Kant and the German philosophy after Kant, with especial reference to their ethical significance. The *Kritik der reinen Vernunft* has been read entire, and a special study made of ethics and the philosophy of religion as they are presented by Kant and Hegel and in the contemporary writings of Herbert Spencer, Sidgwick, Martineau, Royce, Sorley, and others. Mr. Pott submitted, in part fulfilment of the conditions requisite for the attainment of the degree of Doctor of Philosophy, a very able thesis on "Modern Ethics." The thesis was submitted to Prof. Francis L. Patton, of Princeton College, who in his report on it says: "I read it with great care and beg to express my entire approval of it. The writer shows a very creditable acquaintance with the genetic relations of current ethical problems to ethical thought of a former day. His criticisms of prevailing systems are acute and appreciative. \* \* \* It is my opinion that it should be unhesitatingly approved as a fulfilment in part of the conditions necessary to the attainment of the degree of Doctor of Philosophy." Mr. Pott's examination was participated in by Prof. Henry M. McCracken, of the University of the City of New York, and embraced a defence of his thesis as well as the philosophy of Kant. The examination was exhaustive, and the candidate acquitted himself most creditably. He is accordingly recommended to the degree of Doctor of Philosophy.

4. *Extra Classes.*—In response to a demand for wider instruction in philosophy than that announced as part of the regular curriculum, two special classes were formed in October last, each attending two hours a week, for the study of Berkeley's philosophy, with especial reference to the problems of Ethics and Natural Theology. The one class has been composed of four Seniors, the other of eighteen Juniors, and both classes have read and discussed Berkeley's "Essay on Vision," and his "Principles of Human Knowledge." Important philosophical and ethical questions have been discussed as they arose during the year. The attendance at the second of these classes was seriously diminished during the second term, owing to the fact that the hour at



which the class met conflicted with some of the regular college exercises. But unfortunately no other arrangement was feasible.

In addition to the work above detailed, two public lectures were, by special permission of the Trustees, delivered in the month of April on Pædagogics.

The work of all the classes has been earnest and thorough and it is due to the members of the extra classes to say that in most instances they have attended at no small sacrifice of their personal convenience.

Respectfully submitted,

NICHOLAS MURRAY BUTLER,  
*In Charge of the Department of Philosophy,  
Ethics, and Psychology.*

Columbia College, May 20, 1886.

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DEPARMTENT OF POLITICAL ECONOMY AND  
SOCIAL SCIENCE.

*To the President of Columbia College:*

I have the honor to submit the following report of the work done in this department in the School of Arts:

The Junior class has received instruction by text-book two hours per week during the second term.

The Senior class has received instruction by lecture four hours per week throughout the year.

Respectfully submitted,

RICHMOND MAYO SMITH,  
*Professor of Political Economy and  
Social Science.*

Columbia College, May 12, 1886.

DEPARTMENT OF THE ENGLISH LANGUAGE  
AND LITERATURE.

*To the President of Columbia College :*

I beg leave to make the following report upon the work done during the session of 1885-86 in the Department of English :

In this work there has been, I am glad to say, no break either from illness or from any other cause. The duties assigned to each instructor and assistant have been regularly discharged.

The Freshman class, during both terms, has been each week once with me and twice with Dr. Quackenbos. With me, it has studied the logical analysis and syntax of the language, has had lectures on the lives and writings of great contemporary poets, and has read some of their poems, with minute examination of matter, grammar, and style. With Dr. Quackenbos, as shown by his report, it has studied the elements of rhetoric and composition, and the history of literature, and it has written monthly exercises.

The Sophomore class also has been each week once with me and twice with Dr. Quackenbos. With me, it has studied the historical grammar and inflections of the English language, and has read Shakespere's Julius Cæsar, with minute examination of plot, thought, and language. With Dr. Quackenbos, it has carried on the study of rhetoric and composition and of the history of the literature, and it has written monthly essays.

The Junior class has been each week twice with me and once with Dr. Jackson. With Dr. Jackson, whose teaching has been given with admirable spirit and effectiveness, this class has studied the elements of Anglo-Saxon. For full details I beg leave to refer you to Dr. Jackson's enclosed report. With me, the class has studied the higher rhetoric, chiefly the construction of the sentence and the paragraph, the philosophy of literature and criticism, and the works and style of Bacon and Milton, much of whose writings it

has read. For practice in composition this class has written, every two or three weeks, exercises in the various kinds of prose.

The Senior class has been each week twice with me. It has studied the higher theory of composition, with especial regard to the construction and arrangement of discourse in its various kinds, the historical grammar of the English language, including the Anglo-Saxon and the Early English periods, and finally a full course on the history and development of English rhythms and practical forms. It has read with me passages of Anglo-Saxon poetry, and much of Chaucer's poetry, and studied the forms and syntax of Chaucer's language. For practice in composition the Senior class has written a graduated course of essays.

A small class of young men, all graduates of the College, has carried on with me a regular course of graduate work in English and Teutonic philology. They have read with me twice a week in Gothic, Anglo-Saxon, and Early English literature, and pursued regular studies in the grammars of those languages. They have worked with much enthusiasm and have made much progress.

The Fellows of the College that were assigned to my department, Messrs. Jackson, Dodge, and Spencer, have done their work faithfully and with ever increasing efficiency. I beg to refer you to the special reports and recommendations that in respect to these gentlemen I have already made to you.

Respectfully submitted,

THOMAS R. PRICE,  
*Professor of the English Language  
and Literature.*

Columbia College, April 30, 1886.

*INSTRUCTION IN THE HISTORY OF ENGLISH  
LITERATURE.*

*To Professor Thomas R. Price :*

I have to report that during the past year the Sophomore class has received instruction in the history of English Literature and in the principles of figures and style. The lectures have been rendered practical by the free use of examples and illustrative extracts, and abundant references have been furnished for collateral reading in connection with the subjects discussed. The recent additions to the list of books in the department of English Literature are invaluable to our many readers, who are now, in a great measure, saved the inconvenience of searching for volumes recommended for consultation in the libraries of this city and Brooklyn.

The Freshman class has been similarly instructed in the history of English Literature, in punctuation, and in the art of prose composition.

Essays have been prepared, as heretofore, by the members of each class, and the corrections have been explained in the presence of the several authors.

Respectfully submitted,

JOHN D. QUACKENBOS,  
*Adjunct Professor of English.*

Columbia College, May 1, 1886.

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*SPECIAL REPORT ON ANGLO-SAXON.*

*To Professor Thomas R. Price :*

To the Senior and Junior classes I have given each week seven hours' instruction in Anglo-Saxon throughout the year.

Twenty-six Seniors have taken Anglo-Saxon as an elective study, and the class was divided into three sections.

They have read in Sweet's Anglo-Saxon Reader six extracts, selected from the Chronicle, the Laws, and from the works of Alfred, Alfric, and the poet Cynewulf. One section, also, as voluntary work, has read two additional selections. The daily reading of the texts has been accompanied by explanations of a grammatical, philological, historical, or literary character. During the first term a thorough review of the grammar was given, and, in addition to the regular examinations, each student handed in as an extra exercise copies in tabular form of all the paradigms that formed the particular study of the month. In the second term, beside, they received instruction in Anglo-Saxon prose composition; and a special study was made of the phonetic laws of the language.

The two sections of the Junior class, each attending one hour a week, have used Sweet's Anglo-Saxon Primer. The first term was devoted to acquiring a knowledge of the grammar, and constant drill was given in the paradigms. The second has been occupied in reading Alfric's Account of Samson and two other selections, with a practical application of the grammar. In connection with the reading, also, special stress has been laid on parallel syntax, with reference to the likeness or difference between the syntax of the Anglo-Saxon and other languages.

The daily attendance during the year and general attention to the study have been most satisfactory.

Respectfully submitted,

A. V. WILLIAMS JACKSON,

*Fellow in Letters, Instructor in Anglo-Saxon.*

Columbia College, May 1, 1886.

*DEPARTMENT OF MODERN LANGUAGES AND  
FOREIGN LITERATURE.*

*To the President of Columbia College :*

I have the honor of submitting the following report of the work of the Department of Modern Languages and Foreign Literature during the past year :

According to existing rules, French and German are elective during the first three years; Spanish and Italian, save by special authorization, only during the final years of the course. One of the two languages first mentioned is obligatory for two years, while the choice made at the beginning of the course is binding upon the student for an additional year if he remains in the department. The foregoing statement is necessary to explain the falling off in the third year, and the small attendance upon the courses in Italian and Spanish.

The students in the department have been distributed as follows:

*Romance Languages.*

French .....	170
Spanish .....	28
Italian .....	6
Graduates.....	1
	<hr/>
Total .....	205

*Germanic Languages.*

German.....	98
Graduates.....	4
	<hr/>
Total .....	102

*Arranged according to Courses.*

	French.	German.	Spanish.	Italian.
First year.....	42	32	17	2
Second year.....	57	23	8	3
Third year.....	9	20	1	0
Fourth year.....	8	6	1	0
Lectures.....	17 (4 lects.)	17 (3 lects.)	1 (1 lect.)	1 (1 lect.)
Special course in French.....	27			

### WORK OF DEPARTMENT IN DETAIL—ROMANCE LANGUAGES.

*French*—FIRST YEAR.—Chardenal's first French course completed. Reading: *La Mère de la Marquise*, of E. About, 135 pages. Instructors: first term, Mr. Speranza; second term, Dr. O'Connor.

SECOND YEAR.—Chardenal's second French course and Roullier's second book of French composition, embracing about 150 pages of written translation. Syntax in Brachet's *Petite Grammaire Française*. Reading to the extent of about 400 pages. Instructors: first term, Dr. O'Connor and Mr. Scribner; second term, Mr. Scribner.

THIRD YEAR.—First term, Pailleron's *Le Monde où l'on s'ennuie* and Ohnet's *Le Maître de Forges*, with ten essays in French. Second term: Corneille's *Le Cid* and Molière's *Le Tartuffe*, with six essays. Instructor, Dr. O'Connor.

FOURTH YEAR.—Reading: some 1,200 pages, with brief essays. In addition, French composition to extent of about 100 pages. Instructor, Mr. Scribner.

*Special Course* (wholly in French).—Two lectures a week on the literature of the 19th century. In connection therewith, 2,000 pages read and six essays presented. Instructor, Mr. Scribner.

*Lectures*.—From origin to close of 17th century, twice a week. 18th and 19th centuries, twice a week. Instructor, Mr. Scribner.

*Voluntary Classes*.—(1) For extra reading, instructor, Professor Smith. (2) Lectures in French (20) on France and its institutions. Instructor, Mr. Scribner.

*Spanish*—FIRST YEAR.—Josse's Grammar. Reading, 50 pages from Mantilla's *Libro de Lectura* and 12 chapters from *Gil Blas*. Instructor, Mr. Deghuée.

SECOND YEAR.—Reading, 150 pages from *Don Quixote*. In addition, translations into Spanish, and a few informal lectures on Cervantes' life and works. Instructor, Mr. Deghuée.

THIRD YEAR.—Reading: 200 pages from *Don Quixote*, and

two dramas, *Si no vieran las Mujeres* and *El Desden con el Desden*. Instructor, Mr. Deghuée.

FOURTH YEAR.—First term, *Romancero del Cid*, including all the various romances collected from different editions. Second Term, *Coplas de Manrique*, first part of *Poema del Cid*, *Los Reyes Magos*, *Los Reyes de Oriente*, *Yusuf*, and selections from *Santa Maria Egipcíaca*, *Libro de Alexandro*, *Libro de Appolonio*, and *Poesias de Gonzalo de Berceo*. Instructor, Professor Smith.

*Lectures* (once a week).—Spanish literature from its origin to the present. Instructor, Prof. Smith.

*Italian*—FIRST YEAR.—Sauer's Grammar. Reading: 60 pages from Silvio Pellico's *Le mie Prigioni*, and 30 pages of selections. Instructor, Mr. Speranza.

SECOND YEAR.—The unusual capacity and diligence of this class rendered it possible to undertake work far in advance of that assigned. Reading: 200 pages of selections from Puccianti's *Antologia* and 26 cantos of the *Inferno*; 10 compositions in Italian and the translation of the whole of Macaulay's essay on Macchiavelli. In addition, several selections from prose and poetry were memorized, and considerable practice in conversation afforded. Instructor, Mr. Speranza.

THIRD AND FOURTH YEARS.—No classes.

*Lectures* (once a week).—General development of Italian literature, and special study of Dante, Petrarch, Boccaccio, Poliziono, Ariosto, Macchiavelli, Tasso, Metastasio, Goldoni, Parini, Alfieri Foscolo, Leopardi, and Manzoni. Instructor, Mr. Speranza.

### *Graduate Work.*

*Old French*.—Bartsch's *Chrestomathie* and *Aucassin and Nicolette*.

*Provençal*.—Bartsch's *Chrestomathie*.

*Low Latin*.—Inscriptions, charts, glossaries, etc., in Paul Meyer's *Recueil*. Critical study of languages and comparison with other members of Romance family. Instructor, Dr. O'Connor.



*Germanic Department.*

*German*—FIRST YEAR.—Whitney's Brief Grammar and about 35 pages of text from Whitney's Reader. Exercises in translation from Stahl's versions. Instructors: Prof. Boyesen, Dr. Carpenter, and Mr. Deghuée, first term; second term, Prof. Boyesen and Dr. Carpenter.

SECOND YEAR.—Schiller's *Wilhelm Tell*, 1st act, and selections from 2d, 3d, and 4th; also 50 pages from Heine's prose. Exercises in translation from English. Special attention paid to grammar and philology. Instructor, Dr. Carpenter.

THIRD YEAR.—Two Courses—Practical, first term: In class, 50 pages from Schiller's Thirty Years' War. Outside reading average 50 pages. Exercises in conversation. Second term: Schiller, 80 pages. Reading at sight in class 70 pages, including *Der Raufbold* of Turgenieff, and *Der Dachs auf Lichtness* of Riehl. Reading aloud to class by Professor and explanations in German of 75 pages from Andersen. Private reading average 110 pages. Total, first term, 100 pages; second term, 340 pages. Instructor, Prof. Smith.

*Faust Section*.—First part entire, and extracts from second. Six lectures on the second part and on the significance of the Faust legend given in connection with this course. Instructor, Prof. Boyesen.

FOURTH YEAR—First term, Benedix *Das Lügen*. Second term, Lessing's *Laokoön*, with informal lectures on æsthetics and the history of German art criticism. Instructor, Prof. Boyesen.

*Lectures*.—German literature from its origin to the present (twice a week). Instructor, Prof. Boyesen.

*Philology* (once a week).—Introduction to Germanic philology. Instructor, Dr. Carpenter.

*Voluntary Classes*.—Exercises in extemporaneous translation and conversation. In connection with this course a few informal lectures in German. Instructor, Prof. Boyesen. A few students also pursued courses under Mr. Arrowsmith.

*Graduate Work.**Scandinavian.*

*Swedish*.—Grammar, Tegner's *Frithiof* and extracts in prose and verse from other authors. Instructor, Prof. Boyesen.

*Icelandic* (advanced class).—*Volsunga Saga*, *Gunnlang's Saga*, and several lays from the elder Edda. Instructor, Prof. Smith.

*Lectures*.—Danish and Swedish literature, illustrated by extracts from all the more prominent authors. Instructor, Professor Smith.

*Old High German*.—Hahn's *Althochdeutsche Grammatik*. Instructor, Dr. Carpenter.

*Middle High German*.—Wimbold's *Mittelhochdeutsche Grammatik* and some eighty pages from *Lesebuch* by same author. Instructor, Dr. Carpenter.

A seminar in Germanic philology, under the charge of Dr. Carpenter, was organized during the year, holding sessions of two consecutive hours in alternate weeks. Subjects were announced beforehand, and from each member in rotation principal papers were required, bearing thereon, which then formed basis for discussion. The results have been highly profitable.

*Survey of Department*.—Your professor devoted two hours a week during the first term to visiting the various classes of his associates, and found the general condition of the department, both as regards instruction and discipline, entirely satisfactory. In conclusion, he would respectfully call your attention to the present provision for instruction in Italian and Spanish, and for that of the third year of the existing courses in French and German, and to the need of some change as to these.

Respectfully submitted,

CHARLES SPRAGUE SMITH,  
*Professor of Modern Languages and  
Foreign Literature.*

Columbia College, May 13, 1886.

REPORT ON GEODESY AND PRACTICAL  
ASTRONOMY.

*To the President of Columbia College :*

I have the honor to transmit herewith the report of work done during the year in the Department of Geodesy and Practical Astronomy.

## IN THE SCHOOL OF ARTS.

(1) *The Post-Graduate Class* has thoroughly read one hundred pages of Gauss' *Theoria Motus Corporum Celestium*. There were four students in this class, who attended me once a week.

(2) *The Senior Class* (elective) in Practical Astronomy numbers four. This class attends twice a week in the lecture-room, and devotes many hours to observatory work. The work accomplished was very nearly as stated in the Handbook of Information. Some of the students have done extra work.

(3) *The Senior Class* in Descriptive Astronomy, under the charge of Prof. Peck, has been given opportunities for visiting the observatory.

(4) Miss Winifred Edgerton has continued her work in Astronomy, and is engaged on a determination of the latitude of the observatory as part of her work for the degree of Ph.D.

(5) During the year many hundred persons have visited the observatory.

Respectfully submitted,

J. K. REES,  
*Professor of Geodesy and Practical  
Astronomy.*

Columbia College, May 15, 1886.

## DEPARTMENT OF CHEMISTRY.

*To the President of Columbia College :*

I have the honor to report that in the Academic Department of the College I have met the Sophomore class once a week during the past year, and have given instruction by lecture, with monthly examinations, on the non-metallic elements and their compounds, including the chemistry of the atmosphere and the chemistry and composition of water. I find the amount of time allotted to me for this purpose entirely inadequate. Between the hours taken for examination and the hours lost by holidays and vacations, I have on the whole a very small number of lectures. As it has always been the intention to have the Sophomore students well prepared for admission into the School of Mines, it seems desirable that they should be well grounded in the chemistry of the non-metallic elements, and I would respectfully suggest that an allotment of two hours a week would enable me to much more than double the usefulness of this course of instruction. Although the class has been very attentive and regular, it is still difficult to keep up the interest when the exercises come only once a week.

The portion of the Senior class which elected Chemistry has attended two hours a week. During the first session the subject studied was the chemistry of the metals. During the second session, organic chemistry. In addition to the lectures the members of the class have had a weekly recitation, which has been held by Mr. Beebe, one of the Fellows in Chemistry. The progress made by the class has been entirely satisfactory.

There has been one graduate student attending instruction in Chemistry and his work has been very satisfactory. He has attended lectures in the School of Mines and he has worked systematically in the laboratory.

Respectfully submitted,

C. F. CHANDLER,

*Professor of Chemistry.*

Columbia College, May 6, 1886.

## DEPARTMENT OF GEOLOGY.

*To the President of Columbia College :*

I have the honor to report the following lectures delivered in the departments of Geology and Botany to the students in the School of Arts during the academic year 1885-86, viz. :

Geology.....	22
Botany.....	20

Respectfully submitted,

J. S. NEWBERRY,  
*Professor of Geology and Palæontology.*

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 REPORT ON SANSKRIT.

*To the President of Columbia College :*

I have the honor to make the following report of the work done in Sanskrit under my direction during the past college year.

1. A class of three graduates, meeting once a week, has read with me some thirty hymns of the Rig-Veda, following the selections given in Lauman's *Sanskrit Reader*.

2. A second class, composed of two graduates and one Senior, meeting once a week, has gone over with me the larger portion of my *Sanskrit Primer*.

3. A third class, comprising five undergraduates, mostly Juniors, whose other lectures would not permit their attendance in the hours which I was obliged to fix upon for the second class, was very generously formed by Dr. Jackson, of his own offering, during the course of the first term. These have met once a week, and gone over the first part of my *Primer* slowly and thoroughly. No rapid progress was attempted, owing to the large claims made upon the young men's time by their prescribed duties. I have satisfied myself, by several visits to the class, of the excellently

thorough and careful instruction which Dr. Jackson has given.

That I have not given more time to my Sanskrit students, and have not read any courses of lectures supplementary to the ordinary class-work, is in accordance with the earnest advice of my physician, and with that of Dr. Drisler. There is at present every reason to believe that my health will allow me to devote to my Sanskrit classes next year a considerably greater number of hours, and to offer instruction in directions which hitherto we have not been able to follow.

Respectfully submitted,

EDWARD DELAVAN PERRY,

*Instructor in Sanskrit.*

Columbia College, April 30, 1886.

## REPORT ON INSTRUCTION IN HEBREW AND ARABIC.

*To the President of Columbia College:*

I have the honor to present the following report concerning the instruction in Semitic languages given by me during the college year now ending:

### I.—HEBREW.

(a) *Elementary Hebrew*.—One member of the Senior class attended me for one hour each week in elementary Hebrew. During the year, the important portions of Green's Elementary Hebrew Grammar were studied, and a portion of the reading lessons were read and analyzed in connection with the grammar.

(b) *Advanced class*.—Three members of the Senior class, by permission of the Board of Trustees, elected Hebrew as a part of their regular course of study, and attended me two hours each week throughout the year, having previous-

ly studied with me as volunteer students. The work of the year comprised a careful review of the whole subject of grammar, exercises in writing Hebrew, and the reading of selections from the Pentateuch, the Book of Psalms, and the Minor Prophets. Much time was also devoted to the acquisition of a Hebrew vocabulary, and to the commentary. General instruction by lecture was also given, in regard to the history of Hebrew literature and learning, and the philological theories of Meier and Delitzsch.

## II.—ARABIC AND ASSYRIAN.

Several members of the graduate and Senior classes asked for instruction, one in Assyrian, three in Arabic, and one in General Semitic Grammar. All these applications, however, came too late in the year to enable me to make a satisfactory arrangement of hours, but classes will be formed early next year in all these subjects. I think that even more applications would have been received had it been generally known that instruction in Semitic is provided by the College, for in every case the applicant informed me that, had he sooner known of the existence of these courses, he would have been glad to commence work at the beginning of the year.

Respectfully submitted,

H. T. PECK,

*Instructor in Semitic Languages.*

Columbia College, May 30, 1886.

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## REPORT ON INSTRUCTION IN ZEND.

*To the President of Columbia College :*

During the year, one post-graduate student (Mr. Chas. J. Deghuée) has studied Zend, or Avestan, more properly called. The first term was devoted to acquiring a knowledge of the grammar, constant reference being made to the

corresponding forms in Sanskrit. The second term has been spent in translating Vendidad II., VI., Yasna VIII., and Yasht VI. Particular attention has been paid to the interesting and instructive metrical reconstruction of the text where possible. The progress has been very gratifying. Should the work be continued, as it is hoped, next year, several Seniors expect to take up Avestan as an optional study.

Respectfully submitted,

A. V. WILLIAMS JACKSON,  
*Instructor in Zend.*

Columbia College, May 1, 1886.



SCHOOL OF MINES.

APPENDIX B.  
SCHOOL OF MINES.

REPORT ON THE GENERAL STATE OF THE SCHOOL BY THE  
DEAN OF THE FACULTY.

*To the President of Columbia College :*

I have the honor to report that the Twenty-Second Annual Session of the School of Mines now about to close has been in every respect satisfactory.

On last Commencement Day forty-six diplomas were issued to graduates of the School of Mines as follows :

In Mining and Engineering (E.M.) .....	37
Civil Engineering (C.E.) .....	3
Analytical and Applied Chemistry (Ph.B.).....	2
Architecture (Ph.B.).....	3
Geology and Palæontology (Ph.B.).....	1
	<hr/>
	46

In addition to these regular degrees for the four-year courses, there was issued one diploma for the degree of Doctor of Philosophy (Ph.D.) to a graduate of the School of Mines who had pursued advanced studies for an additional year or more.

In addition to the foregoing diplomas, official mention was made at Commencement of six diplomas which had been granted as follows :

In Mining Engineering (E.M.) .....	4
Analytical and Applied Chemistry (Ph.B.).....	1
Civil Engineering (C.E.) .....	1
	<hr/>
	6

Since last Commencement the degree of Mining Engineer was awarded to a member of the Class of '85 who had not previously complied with all the requirements.

During the past year two hundred and forty (240) students have been in attendance on the exercises of the School of Mines, distributed as follows :

First Class .....	73
Second " .....	73
Third " .....	56
Fourth, " .....	34
Resident Graduates .....	4
	<hr/>
	240

These students have pursued the different parallel courses of the School as follows :

	First Class.	Second Class.	Third Class.	Fourth Class.	Res. Grad.	Total.
Mining Eng. ....	30	12	24	18	—	84
Civil Eng. ....	26	24	11	9	—	70
Anal. and App. Chem. ...	12	21	13	4	—	50
Architecture .....	5	14	6	3	—	28
Metallurgy .....	—	2	2	—	—	4
Res. Graduate .....	—	—	—	—	4	4
						<hr/>
						240

The graduating class numbers thirty-four (34) distributed among the parallel courses as follows :

In Mining Engineering.....	18
Civil Engineering .....	9
Analytical and Applied Chemistry.....	4
Architecture .....	3
	<hr/>
	34

It is impossible to say at this time how large a proportion of the class will be able to graduate at Commencement, as the final examinations have not yet been held.

There has been little change in the character or amount of instruction given in the School during the past year. The

time gained by giving up the studies of French and German has been used to great advantage in recitations and practical work in Chemistry, Physics, Biology, and the use of the microscope.

The instruction in Hygiene, by Dr. J. S. Billings, was increased from ten to twenty lectures, which were attended by a very large number of students. Dr. Julien has given special instruction in Microscopy and Biology to students of the second class in the newly-arranged Biological Laboratory. Great interest is exhibited in this subject.

The cabinets of the School have continued to receive valuable additions by purchase and gift: mineralogical, metallurgical, and chemical specimens, rocks, fossils, and models.

Respectfully submitted,

C. F. CHANDLER,

*Dean of the Faculty.*

Columbia College, May 19, 1886.

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DEPARTMENT OF MINERALOGY AND  
METALLURGY.

*To the President of Columbia College :*

As you request, I beg to make the following report of the work that has been done in the two departments under my charge. In the Department of Metallurgy in the second year, the whole work of Blow-piping was reorganized in such a way that the students were able with great ease to themselves to do the work, only two having failed in the examination, which result might have been attained every year if we had had the proper force to do it. This is owing to the fact that Mr. Joseph Struthers, Jr., a graduate of the last class, volunteered to do the work of an assistant in this department, in the expectation of being appointed to a fellowship, which has now been done. This has made it pos-

sible for Mr. Moses and myself to devote our entire time to instruction, with the result that the students have had more instruction than they have ever had in this department before. The two office-boys now do the whole of the mechanical work, Mr. Struthers does the recording and giving out of substances to be examined, Mr. Moses and I do the instruction ; so that every student is able to work independently of every other, and we are able to ascertain exactly how he requires to be instructed. The result is that the Blow-pipe Laboratory has become a pleasure, instead of a labor and a disappointment, as it was before. In the second term of the second year, twenty lectures were delivered upon Crystallography and the Measurement of Angles, the Formation of Crystals, and the Practical Bearings of Mineralogy. Besides seventeen lectures, four conferences were held, where practical instruction was given by both Mr. Moses, Mr. Struthers, and myself, the result of the year's work being extremely satisfactory so far as it is shown in the examinations. It has been found necessary to get another collection of crystal models for the examinations, which it has taken a year to make, and will, I regret to say, absorb a very considerable portion of the funds for the next year. The students of the third year had thirteen conferences and ten lectures upon the subject of Mineralogy and its practical applications during the first term. During the second term they have been engaged exclusively in the laboratory in applying their knowledge of Blow-piping and of Determinate Mineralogy to the determination of such specimens as they would be likely to find in the field. The presence of Mr. Struthers in the laboratory has made this work possible, and the students have been able to do a very large amount of satisfactory work, with great pleasure to themselves, this work being a recreation from their other work, which is more or less fatiguing to them. They have all shown and expressed great pleasure in this reorganization of this department. This reorganization of the department, however, has made a very large amount of extra work necessary during the year. All of the large specimens

have been moved and re-arranged, and will be labelled during the course of the next year. One half of the collection in the table-cases has also been re-arranged, as well as the whole of the collection of pseudo-morphs, the collection illustrating the physical properties of minerals, and a commencement of a collection showing the crystal forms in natural minerals has been made. The whole of the duplicates belonging to the School have been re-arranged and classified, so that it will be possible to give to each student such ores and minerals as he will be likely to find in the field in the same condition as they are found in nature. This has required a very large amount of sorting and re-arrangement in the store-room, which has taken a great deal of time. An endeavor has been made to interest the graduates in these collections, and some few of them have sent such specimens as the students require to determine, to the School in considerable quantities. This department for Determinate Mineralogy is now, I think, as well equipped as any in the United States, and with the assistance which I now have, I shall be able to keep it in that condition. I expect shortly to send out a circular to the graduates, asking them to interest themselves in this very practical turn which I have now been able to give to the department of Mineralogy.

In the Department of Metallurgy, forty-six lectures have been delivered in both the third year and the fourth. I have been able to find time, besides this, to put seven or eight of the lectures into print, which has greatly facilitated the work of the students. I am doing this as rapidly as possible, for I find that the students are very much interested in every thing of this kind that they can get to read, and I have made free use of the School of Mines quarterly for that purpose during the last year. The Metallurgical collection, having had a place assigned to it, has been moved from this floor into the room assigned to it, and is partially arranged. The arrangement of this collection will occupy the larger part of the first term of the next year. Some of it has never been unpacked from the time it was stored when the build-

ing on Fourth Avenue was torn down. I regret to say that it has suffered, but I think that I shall be able to repair most of the damages, as considerable interest is being shown in this department by persons outside of the School. The possibility of exhibiting the specimens has led to a number of donations from abroad, as well as from this country, and I hope before the close of the next year to have this collection as attractive as any other in the School. If we had more assistance, a great deal more could be done to relieve the strain upon the students; but I am too happy to have been able to get the extra assistance to ask for more at the present time, though additional help could be employed here for four or five years with very great advantage. It has become necessary to increase the metallurgical models, and a number of them have been ordered from Europe. I have been obliged, however, on account of not having sufficient funds for the purpose, to countermand the orders for some of them, so it will probably be eighteen months before any more can be added to the collection.

The year has been an unusually busy one, but one of the most profitable and successful since the School opened. I find, however, that it will be necessary in the future to have the permission for students in lower classes to take studies in the upper ones, in my department, always refused, and have only such students pursuing the studies of any class as belong to the class. A great deal of trouble and some unpleasant discipline has become necessary this year by having students of the second year pursuing studies in the third. I have once or twice called attention to this. Whatever it may be in other departments, it is a cause of trouble and annoyance and dissatisfaction in mine; so that I hope in the future no person in a lower class in my department will be allowed to pursue advanced studies.

Yours truly,

THOS. EGLESTON,  
*Professor of Mineralogy and Metallurgy.*

Columbia College, May 22, 1886.

## DEPARTMENT OF CHEMISTRY.

*To the President of Columbia College :*

I have the honor to report that in the Chemical Department of the School of Mines, during the past year, I have met the First-Year students twice a week and lectured upon Elementary Chemistry. The instruction has extended over the non-metallic elements. Dr. Vulté, Fellow in Chemistry, has held recitations on the subjects of the lectures. The class was divided into four sections, and each section recited once a week. In addition to this the First-Year students in the course of Analytical and Applied Chemistry received instruction in Chemical Physics three times a week, during the first term, from Dr. Wiechmann, Fellow in Chemistry, using Cooke's Principles of Chemical Physics.

I have met the Second-Year students twice a week throughout the year. The instruction during the first session related to the metals and their compounds. During the second session it was devoted to Organic Chemistry and limited to the students in the course of Analytical and Applied Chemistry. The class was divided into four sections, which recited, during the first session, once each week to Mr. Beebe or to Dr. Wiechmann, Fellows in Chemistry. During the second session, the subject pursued being Organic Chemistry, the lectures were attended by the students in the course of Analytical and Applied Chemistry only. This section recited once a week to Mr. Beebe. In addition to this the students of the Second Class, pursuing the course of Analytical and Applied Chemistry, have recited four times a week, throughout the year with, Dr. Wiechmann in Chemical Philosophy, having gone entirely through Cooke's Chemical Philosophy, performing all the problems without exception.

I have met the Third-Year students twice a week in Applied Chemistry, and Dr. Laudy, my assistant, has held recitations on the same subject.

I have met the Fourth-Year students, in the course of Analytical and Applied Chemistry, twice a week for instruc-

tion in Applied Chemistry, and recitations have been held by Dr. Laudy.

In Qualitative Analysis Dr. Wells has given two lectures a week, and Dr. Vulté has held weekly recitations upon the subject, the class being divided into four sections.

Prof. Waller has lectured twice a week on Quantitative Analysis to the Second-Year students, in the course of Analytical and Applied Chemistry, during the second term, and twice a week to the students of the Third Class, in the course of Analytical and Applied Chemistry, throughout the year. He has also lectured once a week to the Fourth-Year students, in the course of Mining Engineering, from March first to the end of the session. The Second-Year students have recited twice and the Third-Year students once a week to Mr. Bowen, Fellow in Chemistry.

Prof. Ricketts has lectured twice a week on Assaying, and Mr. Beebe has held weekly recitations on the same subject.

The students in the course of Analytical and Applied Chemistry in the Fourth Year have received special instruction from Mr. C. E. Colby, the Fellow in Chemistry. He has given them seventy-six lectures and recitations during the year upon the various processes of organic analysis, determination of vapor densities, preparation of organic compounds, together with the theoretical principles involved, and each student has had an opportunity to put in practice the principles learned, by preparing in the laboratory a considerable variety of compounds and investigating the same.

In addition to this instruction in the lecture- and recitation-room, the students have practised the various branches of Chemical Analysis, etc., as follows:

The First-Year students—Qualitative Analysis, under Dr. Wells and Dr. Vulté.

The Second-, Third-, and Fourth-Year students—Quantitative Analysis, under Prof. Waller and Mr. Bowen.

The Second- and Third-Year students—Assaying, under Prof. Ricketts and Mr. Beebe, and



The Fourth-Year students in the course of Analytical and Applied Chemistry—Organic Analysis and Investigation, under Mr. Colby.

I submit herewith the accompanying reports from Prof. Waller on the work in Quantitative Analysis; from Prof. Ricketts on the work in Assaying; from Dr. Wells, the Instructor in Analytical Chemistry, on Qualitative Analysis; from Mr. C. E. Colby, Fellow in Chemistry, on the instruction in Organic Chemistry; and from Dr. Wiechmann, Fellow in Chemistry, on the instruction in Chemical Physics and Chemical Philosophy.

The general attendance and progress of the students have been very satisfactory.

Respectfully submitted,

C. F. CHANDLER,  
*Professor of Chemistry.*

Columbia College, May 24, 1886.

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### *SPECIAL REPORT ON QUANTITATIVE ANALYSIS.*

*To Professor C. F. Chandler :*

I have the honor to report the following details regarding the work in my division of Analytical Chemistry during the past college year :

*Lectures* have been delivered by me as follows :

To *Second-Year* students in the course of Analytical and Applied Chemistry, and in the course of Metallurgy : twice a week during the second term. To *Third-Year* students in the course of Analytical and Applied Chemistry : twice a week during the entire year. On three occasions, each term (with both classes), a monthly examination was substituted for the usual lecture. To *Fourth-Year* students in the course of Mining Engineering : once a week from March 1st until the end of the second term.

Recitations or examinations have replaced the usual lectures when it has seemed advisable.

*Examinations* have been held at the end of each term on the work of the term, for those students who failed to pass the monthly examinations.

*Recitations* have been held by Mr. Bowen as follows :

For *Second-Year* students in Chemical and Metallurgical courses : twice a week during the second term. For *Third-Year* students in the Chemical course : twice a week throughout the year.

*Laboratory work*, under the personal supervision of Mr. Bowen and myself—for *Second-Year* students in the Chemical and Metallurgical courses : from the first part of January until the end of the second term.

The subjects which have occupied their attention in lecture-room, class-room, and laboratory have been—

For students in the Chemical course, analyses of :

<i>Substances.</i>	<i>Determinations Required.</i>
1 Barium Chloride.....	Ba, H <sub>2</sub> O, Cl gravimetric and volumetric.
2 Magnesium Sulphate....	MgO, SO <sub>3</sub> .
3 Calcium Carbonate.....	CaO, CO <sub>2</sub> .
4 Potassium Alum.....	K <sub>2</sub> O, Al <sub>2</sub> O <sub>3</sub> .
5 Hydro-disodic Phosphate,	Na <sub>2</sub> O, P <sub>2</sub> O <sub>5</sub> , H <sub>2</sub> O by direct weight.
6 Iron Ammonia Alum....	Fe <sub>2</sub> O <sub>3</sub> by ignition, gravimetric and volumetric.
7 Limestone .....	CaO, MgO, (Fe <sub>2</sub> O <sub>3</sub> and Al <sub>2</sub> O <sub>3</sub> ), SiO <sub>2</sub> , CO <sub>2</sub> .
8 Manganese Mineral.....	Mn, available O.
9 Zinc Ore.....	Zn.
10 Iron Ore.....	Complete analysis.
11 Bar-Iron, Pig-Iron, or C combined and graphitic ; Steel, and Mn.	P, S, Si,
12 Chromic Iron.....	Cr <sub>2</sub> O <sub>3</sub> .
13 Coal .....	H <sub>2</sub> O, Volatile and Fixed C, Ash, S.
14 Slag .....	Complete analysis.

For students in the Metallurgical course, analyses of :

<i>Substances.</i>	<i>Determinations Required.</i>
1 Barium Chloride.....	Ba, Cl, H <sub>2</sub> O.
2 Magnesium Sulphate....	MgO, SO <sub>3</sub> .
3 Ammonio-ferric Sulphate, Fe <sub>2</sub> O <sub>3</sub>	by ignition, by precipitation and volumetrically.
4 Limestone or Cement... CaO, MgO, Fe <sub>2</sub> O <sub>3</sub> , Al <sub>2</sub> O <sub>3</sub> , SiO <sub>2</sub> , CO <sub>2</sub> .	
5 Iron Ore.....	Fe, S, P, Si <sub>2</sub> O.
6 Slag.....	SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> , CaO, MgO, FeO, MnO.
7 Bar-Iron and Steel.....	C, P, S, Si.
8 Coal.....	H <sub>2</sub> O, Volatile Matter, Fixed Carbon, Ash, S.
9 Zinc Ore.....	Zn.
10 Copper Ore.....	Cu, electrolytically, and by precipitation.

The first six on the list for Chemical students, and the first three on that for Metallurgical students, are analyses of pure salts, given in order to familiarize the student with quantitative manipulations. In the remaining substances, the knowledge gained by the preliminary work is applied, and the methods of effecting quantitative separations in special cases have been taught. The attention of the students has been directed, not only to the regular and ordinary methods of gravimetric analysis, but also to the more rapid modes of examination in use in laboratories attached to metallurgical and manufacturing establishments in the country.

For *Third-Year* students in the Chemical and Metallurgical courses the laboratory practice has extended throughout the year.

The work of the first term for the Chemical students has consisted in analyses of :

<i>Substances.</i>	<i>Determinations Required.</i>
15 Titaniferous Iron Ore... TiO <sub>2</sub> , SiO <sub>2</sub> , Fe.	
16 Copper Ore.....	Cu.
17 Arsenic Ore.....	As.
18 Galena.....	Pb, Ag.
19 Antimony Ore.....	Sb.

<i>Substances.</i>	<i>Determinations Required.</i>
20 Paint .....	Complete Analysis.
21 Nickel Ore .....	Ni and Co.
22 German Silver .....	Cu, Zn, Ni.
23 Bronze. ....	Sn, Cu.
24 Type Metal .....	Sb, Pb, Sn.
25 Feldspar .....	SiO <sub>2</sub> , Al <sub>2</sub> O <sub>3</sub> ; K <sub>2</sub> O and Na <sub>2</sub> O.

} Qualitative tests for  
other metals.

This includes the more difficult separations and determinations in ordinary mineral analysis. For the second term the work assigned consisted of analyses as follows :

<i>Substances, etc.</i>	<i>Determinations Required.</i>
26 Alkalimetry .....	Caustic or Carbonated Alkali.
27 Acidimetry .....	Vinegar, Commercial Acids.
28 Cream of Tartar .....	Tartrate, Qualitative Examination.
29 Commercial Bi-Carbonate of Soda .....	Complete Analysis.
30 Acetate of Lime .....	Available Acetic Acid.
31 Butter .....	Water, Fat, Curd, Salts, Sp. Gr., Fatty Acids.
32 Soap .....	Fatty Acid, Water, Alkali combined and free.
33 Chlorimetry .....	Available Chlorine in Bleaching Powder.
34 Raw Sugar .....	Cane Sugar, Glucose, Water, Ash.
35 Flour .....	Starch.
36 Milk .....	Complete analysis.
37 Water .....	Complete analysis.
38 Guano .....	P <sub>2</sub> O <sub>5</sub> , NH <sub>3</sub> , H <sub>2</sub> O, K <sub>2</sub> O.
39 Super-phosphates .....	H <sub>2</sub> O, P <sub>2</sub> O <sub>5</sub> soluble, insoluble, and reduced.
40 Bone Black .....	C, CaCO <sub>3</sub> , Fe, H <sub>2</sub> O.
41 Spirits .....	Alcohol.
42 Commercial Saltpetre, etc. ....	Pure Nitrate.

These include the most important determinations in commercial and sanitary examinations.

The *Fourth-Year* students in the Chemical course also

took places in the laboratory from the beginning of the first term until the first part of January, in order to finish some work not completed last year.

The *Fourth-Year* students in the Mining Engineering course have had laboratory practice from March 1st up to the end of the second term. The short time that these students had to devote to Analytical Chemistry, made it seem advisable to instruct them more particularly in the more rapid methods of work, and a special plan of instruction was laid out to meet the requirements of the case. This consisted in the following : Analyses *required*.

<i>Substances.</i>	<i>Determinations.</i>
Magnesium Sulphate.....	MgO, SO <sub>3</sub> , H <sub>2</sub> O.
Potassium Alum .....	Al <sub>2</sub> O <sub>3</sub> .
Iron Ammonia Alum.....	Fe <sub>2</sub> O <sub>3</sub> gravimetric.
	" volumetric by K <sub>2</sub> Mn <sub>2</sub> O <sub>8</sub> .
	" " " K <sub>2</sub> Cr <sub>2</sub> O <sub>7</sub> .
Iron Ore .....	SiO <sub>2</sub> , Fe volumetric, P volumetric.
Pig-Iron .....	Si and S. (Drown's method).
" .....	P volumetric, Mn volumetric.
Steel .....	C Colorimetric.
Copper Ore .....	Cu volumetric.
Zinc Ore.....	Zn volumetric.

#### *Voluntary Analyses.*

Water .....	Total solids, etc., hardness.
" .....	CaO volumetric, Cl volumetric.
Iron Ore.....	Complete gravimetric analysis.
Coal.....	H <sub>2</sub> O, Volatile and Fixed C, S, Ash.
Galena .....	Pb volumetric.

But few of the class have had time to undertake much of the work classed as "voluntary."

Ten of the *Fourth-Year* Mining Engineering students "elected" Analytical Chemistry this year. Their serious devotion to their work, however, afforded an example which produced a perceptible effect upon the work of members of the younger classes in the laboratory.

It has been unfortunate that the time of these students was so filled up with lectures and other exercises that they could only meet me in the lecture-room on Saturdays at whatever hour might suit the convenience of the class.

As an instance of their earnestness, it may be mentioned that each session in the lecture-room was always voluntarily prolonged, with unflagging interest on their part, beyond the usual limits of one hour. One and a half to two hours was not infrequently the length of each session.

The number of students attending the exercises has been as follows :

	Lectures.	Recitations.	Laboratory.
Second Year—Chemical Course....	18	18	18
“ —Metallurgical Course. 2	2	2	2
Third Year—Chemical Course....	13	13	13
“ —Metallurgical Course.			2
Fourth Year—Chemical Course....			4
“ —Mining Eng. Course. 10			10
	—	—	—
Total.....	43	33	49

For convenience in giving out substances for analysis, and for other reasons, it has been found expedient to put up the specimens for analysis in separate tubes, numbered and labelled. One sample of each substance is delivered to each student as he may be ready to work on it, and a record of the substance, name of the student, and date of delivery is recorded. When the report is handed in, the degree of precision attained is recorded, the report is filed, and the result of the inspection of the report is at once posted for reference by the students.

The obtaining or examination of materials for this purpose, the keeping of the records of their contents, and of the records of each student's work, the care and dispensing of the reagents and articles for common use, combined with giving the necessary personal instruction to whatever students may need it at any time between 9.30 A.M. and 5 P.M. during five days of every week, constitute a serious draft on the time and attention of the two—Mr. Bowen and myself—

who are charged with those duties. I would respectfully suggest that the efficiency of the work done in the Quantitative Laboratory would be materially increased by the employment of another assistant.

All of which is respectfully submitted,

ELWYN WALLER, PH. D.,  
*Professor of Analytical Chemistry.*

Columbia College, May 24, 1886.

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### *SPECIAL REPORT ON ASSAYING.*

*To Professor C. F. Chandler :*

I have the honor to submit the following report as to the instruction given in the Assay Department, and the improvements made in the condition of this department during the school year 1885-86.

During the first term of the present school year I delivered two lectures per week on Assaying to the Second-Year Chemists and Metallurgists, and one lecture per week to the Third-Year Mining Engineers and Metallurgists. The assistant instructor, Mr. A. L. Beebe, held twenty-two recitations on the subject, dividing the class for this purpose into two sections of about ten men each. The practical work in the laboratory was conducted with the aid of Mr. Beebe, and that of the Honorary Fellow in Assaying, Mr. John I. Northrup.

During the second term I have met the Third-Year Mining Engineers and Metallurgists twice a week, and Mr. Beebe has held twenty-one recitations, dividing the class into two sections of about thirteen men each. The instruction in the laboratory and ore-testing works has been conducted with the aid of Mr. Beebe and that of Mr. I. H. Woolson, who was appointed to succeed Mr. Northrup as Honorary Fellow in Assaying.

The total number of students attending the lectures and

laboratory instruction in Assaying during the year is as follows:

Second-Year Chemists.....	17
"    "    Metallurgists.....	2
Third-Year Mining Engineers.....	24
"    "    Metallurgists.....	2
	—
Total.....	45

In addition to the foregoing I have given voluntary instruction in the theory and practice of ore-testing to the Fourth-Year Mining Engineers, fifteen in number.

The average standing of the students has been satisfactory, especially that of the Third- and Fourth-Year men.

The instruction of the students in the laboratory has been greatly facilitated by the appointment of the Honorary Fellow made last fall, the incumbents of this position having proved a valuable addition to the working force of the department.

The following additions and changes have been made: In the ore-testing works, the "Golden Gate" Concentrator donated to the School has been placed in position, and a new sheet-iron sampling floor has been laid, proving to be a great convenience and aid in sampling ores. In the furnace room, a reverberatory roasting furnace, and two new fusion furnaces, large size, with inclined covers, have been built. The arrangement of the muffle furnaces has been changed, doing away with some of the piping heretofore necessary, thus diminishing the heat of the laboratory during working hours, and adding greatly to the comfort of both students and instructors.

Very respectfully yours,

B. P. RICKETTS,  
*Professor of Assaying.*

Columbia College, April 30, 1886.



*SPECIAL REPORT ON QUALITATIVE ANALYSIS.*

*To Professor C. F. Chandler :*

I have the honor to submit the following report of work done in qualitative analysis during the year ending May 15, 1886.

The number attending lectures and laboratory practice was thirty-nine.

The number of lectures given during the year was sixty.

The laboratory has been open four days per week from two to five P.M., and on Saturdays from 10 A.M. to 3 P.M.

I have been assisted in the work of instruction by Dr. H. T. Vulté, Fellow in Chemistry. Dr. Vulté has met the class in four sections once a week, thus giving each student thirty recitations. These recitations are of great benefit to the students, tending to fix the theoretical part of their work more firmly in their minds than could be done by the examinations which are held at comparatively long intervals.

The work of the students has progressed satisfactorily; the class, with few exceptions, appearing to take great interest in the work upon which they were engaged.

Next year when the new requirements for admission go into effect, and previous instruction in chemistry is required, I hope the class will accomplish much more, as much less time will be required to get them fairly at work.

The system of issuing chemicals to the students, in use for the past two years, has proved very successful. The old plan was to allow each student to fill his own bottle from the large stock bottles kept in the laboratory. This was found to result in great waste, so Dr. Vulté volunteered to fill the students' bottles himself and keep an account of the quantities of the different reagents given to each student, allowing each student a limited quantity only. This has been found to result in preventing much waste, and has an excellent effect on the work of the students.

In addition to assisting in the laboratory and holding recitations in qualitative analysis, Dr. Vulté has also met the students of the First Class in four sections, each once a

week, and held recitations upon the lectures in General Chemistry.

The want of proper ventilation in the laboratory is very serious, the system now in use being totally inadequate. The hoods work very badly, and when many students are at work, the air soon becomes foul and unhealthy.

Very respectfully yours,

JAMES S. C. WELLS,  
*Instructor.*

Columbia College, May 10, 1886.

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### *SPECIAL REPORT ON ORGANIC CHEMISTRY.*

*To Professor C. F. Chandler :*

I have the honor to report the following details of the work done in the Organic Laboratory during the college year 1885-86.

The students who have received my instruction are those of the Fourth Class pursuing the course of Analytical and Applied Chemistry, and also those post-graduate students who are devoting themselves to a special course in Chemistry.

The instruction included lectures, recitations, and laboratory work.

*Lectures and Recitations.*—During the first term, the students were taught the methods of ultimate analysis of organic compounds, determination of vapor density, and calculation of formulæ.

The formation, properties, and decompositions of organic bodies were then explained, beginning with the hydrocarbons of the marsh-gas series, and continuing through the fatty group, in the following order :

Hydrocarbons, saturated and unsaturated.

Halogen Derivatives of Hydrocarbons, Haloid Ethers.

Nitro-paraffins.

Azo-paraffins, Cyanides, and Nitrils.

Amido derivatives or Amines.  
Hydroxyl derivatives or Alcohols.  
Oxygen Ethers.  
Thio-alcohols and Thio-ethers.  
Aldehydes and Ketones.  
Organic Acids.  
Substitution derivatives of Fatty Acids.  
Acid Halides and Anhydrides.  
Amides of the Fatty Acids.  
Amides of Carbonic Acid including Compound Ureas.

The students attended thirteen lectures and twelve recitations during the first session.

During the second session, the students studied the derivatives of Benzene, or the Aromatic group of organic compounds, in the following order:

Comparison of the compounds of the Aromatic group with those of the Fatty.

Benzene.—Its formula and theory of its constitution.

Isomerism of its derivatives. Relations and designation of its isomeric compounds.

Formation and properties of the Aromatic Hydrocarbons.

Halogen derivatives.

Nitro and Nitroso substitution products.

Amido derivatives and Amine bases.

Azo and Diazo compounds.

Sulpho-acids. Thio-alcohols and Thio-ethers.

Phenols and Chinons.

Aromatic Alcohols, Aldehydes, and Ketones.

Aromatic acids.

Derivatives of Toluene, Xylene, Ethyl benzene, and Propyl benzene.

Unsaturated hydrocarbons and their derivatives.

Derivatives of Diphenyl methane and Triphenyl methane.

Diphenyl Group.

Derivatives of Naphthalene.

Derivatives of Anthracene.

The students attended twenty-five lectures and twenty-six recitations during the second session. The object of

these lectures was to acquaint the students with the theory of the various methods of synthesis.

*Laboratory Work.*—Each student began his laboratory work with an ultimate analysis of an organic substance whose composition was unknown to him. He was required to accurately estimate the percentage of Carbon, Hydrogen, Nitrogen, and Oxygen ; to determine its Vapor Density, calculate its formula, and identify it.

The remainder of the year was devoted to the preparation of a limited number of organic compounds by synthesis. This work was so selected and distributed that the students had individual practice in the more important laboratory operations, such as oxidation and reduction, nitration and sulphonation, the preparation of Halogen derivatives, the uses of such reagents as methyl iodide and acetyl chloride, and the condensation of two or more molecules into one. A practical application was thus made of the reactions taught in the lectures.

Each student prepared an average of twenty-five organic substances during the year. Among the more important compounds made are the following :

Ethylene,	Tetra ethyl diamido tripheny
Diphenyl,	methane.
Diphenyl ethane,	Propyl chloride,
Nitro ethane,	Iso butyl bromide,
Ceryl alcohol,	Ethylene bromide,
Propyl ether,	Vinyl bromide,
Iso butyl ether,	Dichlor hydrin,
Iso amyl ether,	Tetra allyl ammonium iodide,
Succinic diethyl ether,	Diamido diphenyl,
Ethylene diacetate,	Benzylamine,
Propionic aldehyde,	Para phenylene diamine,
Thio benzaldehyde,	Toluylene diamine,
Para nitro benzaldehyde,	Thio carbanilide,
Diphenol,	Phenyl iso thio cyanide,
Tetra nitro diphenol,	Thio carbamide,
Propionyl chloride,	Biuret,
Propionic anhydride,	Allyl iso thio cyanide,

Butyryl chloride,	Mono chlor acetic acid,
Butyric anhydride,	Tri chlor acetic acid,
Succinyl chloride,	Cyan acetic acid,
Succinic anhydride,	Malonic acid,
Ortho-nitro benzoyl chloride,	Cerotic acid,
Diacetamide,	Phenyl acetic acid,
Triacetamide,	O nitro phenyl acetic acid,
Propionamide,	O nitro benzoic acid,
Butyramide,	Butyro nitril,
Valerianamide,	Valero nitril,
Succinamide,	Capro nitril,
Succinimide,	Benzo nitril,
Succinamic acid,	Benzyl cyanide,
Butyranilid,	Ethylene cyanide,
Ethyl acetanilid,	Hydrazo benzene,
Ortho acet toluid,	Dibrom diphenyl,
Para acet toluid,	Diphenyl disulpho acid,
Ortho nitraniline para sulpho acid,	Ortho benzoyl benzoic acid,
Formo diphenyl amin,	Benzoin,
Iso amyl phenol,	Disozybenzoin,
Diamido triphenyl methane,	Dibenzoyl.

Practical instruction was given in dyeing. The students prepared the following dyestuffs synthetically and applied them to wool:

<i>Commercial Name.</i>	<i>Chemical Name.</i>
Naphtol Yellow S,	Dinitro naphtol sulpho acid.
Palatine Orange,	Tetranitro diphenol.
Brilliant Green,	Tetra ethyl diamido triphenol carbinol.
Orseille Brown,	Naphtyl amin azo benzol sulpho acid.
Ponceau R.,	Xylol azo B. naphtol disulpho acid.
Ponceau R. R.,	Cumol azo B. naphtol disulpho acid.
Ponceau S extra,	Benzol azo benzol azo B. naphtol disulpho acid.
Biebrich Scarlet,	Benzol sulpho acid azo benzol azo B. naphtol.
Crocein Scarlet,	Benzol sulpho acid azo benzol azo B. naphtol mono sulpho acid.
Lauth's Violet,	

Calico printing was taught, and the class had individual practice with the calico-printing machine. They printed with the following substances: artificial indigo, aniline black with vanadium salts, and a discharge style on Turkey red. They all dyed mordanted cotton cloth with alizarines.

The class commenced the laboratory work about the first of December, and each student has spent an average of thirty-five hours per week in the laboratory since that time.

Respectfully submitted,

CHARLES E. COLBY,

*Fellow in Chemistry.*

Columbia College, May 15, 1886.

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*SPECIAL REPORT ON INSTRUCTION IN CHEMICAL PHYSICS AND CHEMICAL PHILOSOPHY.*

*To Professor C. F. Chandler :*

I have the honor of submitting to you the following report for the year 1885-86:

The First-Year students in the course of Analytical and Applied Chemistry I met three times a week during the first term. They received instruction in Chemical Physics. The work consisted in recitations, demonstrations at the black-board, and a few lectures. The text-book used was Cooke's Principles of Chemical Physics.

During the first term I also met (each once a week), two sections of Second-Year students in the courses of Civil and of Mining Engineering. The time was spent in questionings on, and a thorough review of, the subject-matter of the lectures on General Chemistry delivered by the Professor of Chemistry.

The Second-Year students in the Course of Analytical and Applied Chemistry I met four times a week throughout the year for instruction in Chemical Philosophy. The instruction given consisted in lectures, demonstrations at the

black-board, and recitations from the text-book used—Cooke's Principles of Chemical Philosophy. Special stress was laid on the solving of a great variety of problems, embracing all the principles of Stoichiometry.

The total number of hours given was two hundred and four; the total number of students instructed, sixty-three.

They were divided as follows:

Subject.	No. of Students.	No. of Hours.
Chemical Physics.....	12	48
Chemical Philosophy.....	18	124
Quiz on General Chemistry.....	33	32
		<hr/> 204

Very respectfully yours,

F. G. WIECHMANN, PH.D.,

*Fellow in Chemistry.*

Columbia College, May 30, 1886.

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### DEPARTMENT OF MECHANICS.

*To the President of Columbia College:*

Forty-two members of the Third class have been instructed in advanced Mechanics two hours a week throughout the year. For the purposes of drill and recitation, the class has been divided into two sections, one of which has attended me, and the other has been instructed by Professor Rees. For the purpose of listening to lectures, the sections attend as a class. The lecture part of the course has been devoted to the methods of applying the Calculus to the problems of centre of gravity, friction, general laws of motion, moment of inertia, motion of fluids, and the like. These lectures have been numerous, and the students have been held to a rigorous examination on them all.

More time is needed, and I beg leave to recommend that one additional hour per week be given to this most important subject.

Respectfully submitted,

WILLIAM G. PECK,

*Professor of Mechanics and Astronomy.*

Columbia College, May 30, 1886.

## DEPARTMENT OF MATHEMATICS.

*To the President of Columbia College :*

I have the honor to report that, during the past year, the First and Second classes have attended in Mathematics as follows :

The First class, three times in sections and once as a class—in all four times per week ;

The Second class, once in sections and three times as a class—in all four times per week ;

and have accomplished the course of study as set forth in the Handbook of Information for the year. The more proficient students in the two classes have, as usual, accomplished considerable work outside and in advance of the prescribed curriculum.

In consequence of partial assistance rendered by Fellows of the School of Arts, assigned to the department, it has been possible to require an unusual number of exercises, written and oral, from members of both the classes, but particularly from members of the First class. The result has been very satisfactory, not only in raising the average of accomplishment, but also in giving larger opportunity to the better students to take a more advanced course.

Very respectfully,

J. H. VAN AMRINGE,  
*Professor of Mathematics.*

Columbia College, May 17, 1886.

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DEPARTMENT OF PHYSICS.

*To the President of Columbia College :*

The following is a statement of the work done in the Physical Department in the School of Mines and the School for Instruction for Graduates :

The *Third-Year class* in the School of Mines was occu-



pied two hours per week during the first and second terms on the same subjects as the elective Seniors.

*First-Year class* was occupied three hours per week during the first and three hours during the second term, as follows:

Expansion of solids, liquids, and gases; mercurial and air thermometer; maximum and minimum thermometer; density of gases; vapors, and tension of; evaporation; ice machines; hygrometry; conduction of heat by solids, liquids, and gases; radiant heat; latent heat of liquids and gases; high- and low-pressure steam-engines; magnetism; magnetic induction; terrestrial magnetism; magnetic attractions and repulsions.

Frictional electricity; induction; electrical attractions and repulsions; Holtz's machine; electroscope; electrophorus; spark, nature and duration of; Leyden jar; Franklin's plate; discharger; electrometers; mechanical, chemical, calorific, and magnetic effects of the discharge.

Galvani's observations; Volta's experiments; constant batteries; Oersted's experiment; properties of the electric light; electrometallurgy and decomposition of salts; magnetism by currents; telegraphy; induction by magnets; Gramme machine; Rumkorff coil; induction; diamagnetism; thermo-electricity.

Optics: velocity and intensity; photometers; reflection; mirrors, plane, concave, and convex; refraction by plates and prisms; spectra; spectroscope; chemical lines; fluorescence; achromatism; simple and compound microscopes; telescopes; camera obscura; solar microscope; photography; eye and vision.

Acoustics: propagation and velocity of sound in solids, liquids, and gases; reflection and refraction of sound; measurement of the number of vibrations; chronograph; tuning-fork; synthesis of sounds; interference; vibration of strings; organ-pipes; vibrations of rods, plates, and bells; Lissajous' experiment; phonautograph, telephone, phonograph, etc.

Many problems relating to the above were solved by the different classes.

*Physical Laboratory.*—Several post-graduate students were occupied two hours per week during the first and second terms, as follows: Estimation of tenths, linear and circular divisions, with practice on scales of their own construction, and also on various instruments; construction and use of verniers; construction of cross hairs for telescopes and microscopes: silk-fibre suspensions; use of the straight dividing engine; use of the circular dividing engine; use of the barometer; measurement of angles of crystals with the goniometer; spherometer; measurements of thickness and measurements of the curvature of lenses; measurement of angles with the spectrometer; use of the kathetometer; measurements with the aid of reading microscopes; use of the balance and determinations of specific gravity.

Mr. Share assisted in giving instruction in the physical laboratory. Mr. Ewing assumed two hours per week of the instruction of the First-Year class in the School of Mines, the class being divided into four sections, which gave him eight hours per week.

Respectfully submitted,

OGDEN N. ROOD,

*Professor of Physics.*

Columbia College, April 15, 1886.

## DEPARTMENTS OF GEOLOGY AND BOTANY.

*To the President of Columbia College:*

I have the honor to report the following lectures delivered in the departments of Economic Geology, Geology, Zoölogy, and Botany in the School of Mines during the academic year 1885-6, viz.:

Economic Geology.....	64
Geology .....	62
Zoölogy .....	24
Botany .....	22

A large amount of work has also been done in the Geological Museum and in the Herbarium. Dr. Britton has taken the lectures on Botany, and I have given an additional lecture per week in Economic Geology, where I was more needed. When not engaged in teaching, Mr. Britton has been constantly occupied in transferring the plants of the Herbarium to the new rooms in the library building, and rearranging them there. This has now been more than half accomplished. A report from Dr. Britton, hereto appended, shows the value of the additions made to the collections during the past year.

Yours respectfully,

J. S. NEWBERRY.

*Professor of Geology.*

Columbia College, May 19, 1886.

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*SPECIAL REPORT ON ADDITIONS TO HERBARIUM.*

*To Professor J. S. Newberry :*

The additions to the Botanical Collections during the past year have been as follows :

70 Specimens, plants from Oregon and Washington, value.....	\$3.00
1200 Specimens, plants from Japan, Siberia, etc.	120.00
300 Species N. A. grasses.....	24.00
273 " plants from Chihuahua, Mexico..	21.84
200 Miscellaneous specimens.....	20.00
<hr/>	
2043 Specimens, valued at.....	\$188.84

The appropriation has been mainly expended in mounting and rearranging old material necessitated by the removal of the Herbarium from the old building to the library building.

Respectfully submitted,

N. L. BRITTON,

*Instructor in Botany.*

Columbia College, June 8, 1886.

*DEPARTMENT OF ENGINEERING.*

*To the President of Columbia College :*

I furnish you herewith a statement of the operations of my department during the past year, including the work of myself and of each of the officers associated with me.

I have myself given ten lectures per week throughout the College year. The subjects embraced in these have been Mining, Engineering, Civil Engineering, Mechanical or Dynamic Engineering, and Sanitary Engineering. In addition to these I have exercised supervision of the instruction in Drawing, Descriptive Geometry, and Graphics, given by other officers in all the four classes. I have also directed the scope and details of this instruction, giving at least an hour each day of my time to personal instruction and supervision in the drawing rooms, and generally more.

In addition to these duties I have as usual directed the scope and progress of the Summer Schools of Practical Mining and Surveying, which are under the immediate charge of Adjunct-Professor Munroe. I am expressly charged by the statutes with the expenditures in these branches of instruction.

I have also exercised the required supervision over the general instruction covered by the courses of lectures of Adjunct-Professors Munroe and Hutton and Mr. Greenleaf, Instructor in Engineering. Mr. Greenleaf's instruction has included a course of Railroad Surveying in the field, and an extended course in Drawing and Designing Graphical Statics and Sanitary Engineering, the latter having been given to the Architectural students alone.

Professor Munroe's course of lectures has included Practical Mining, Ore dressing, and Surveying.

Professor Hutton's lectures have embraced Mechanical Engineering, Kinematics, and Properties of Materials.

In regard to hours of attendance, I have been always at the School of Mines at 9 A. M. and have remained until about half past 3 P. M. ; during which period each day I have found my time wholly absorbed in directing the instruction

in my department, and in giving lectures. I have also had charge of and am responsible for the expenditures in the Engineering Department and in Drawing, and have had the care of all models and public property in this department. I may say further that I have devoted two to three hours every evening to study and preparation for my lectures.

Adjunct-Professor Munroe gave six lectures a week from November 15th to May 20th. He has a vacation each year during the six weeks immediately after the opening of the first term, in consequence of his engagement during the summer preceding for six weeks in the Summer School of Practical Mining and for six weeks in the Summer School of Surveying. During these periods he gives practical instruction and lectures in the field, both in Practical Mining and in Surveying, and his time is necessarily almost wholly occupied throughout the regular summer vacation.

Adjunct-Professor Hutton has given eight lectures per week during the whole College year on Mechanical Engineering, Civil Engineering, and the Properties of Materials. He has no required work in the field nor in the drawing-room ; but has given voluntarily a course of instruction to about twenty members of the Second Class in shop practice during the summer, the time occupied being about four weeks. Dr. Hutton has also had general charge of the heating and ventilating apparatus and of the electrical plant and machinery ; but this does not come under the supervision of the Engineering Department. Professor Munroe and Professor Hutton are not required absolutely to be at the School of Mines at any time except during their lectures, but both spend much of their time in the mornings at the School.

Mr. Greenleaf, Instructor in Civil Engineering, has given five lectures a week during the whole year ; three on Sanitary Engineering, Heating, Ventilation, and House Drainage, and two on Civil Engineering and Engineering Design. He has also conducted the instruction in Railroad Surveying in the field during about six weeks at the beginning of the first term of each year. He has, moreover, devoted each after-

noon throughout the year to the instruction of the Third and Fourth classes in Engineering Construction and Design.

Mr. Churchill, Instructor in Drawing, has given three lectures a week throughout the year, two in Descriptive Geometry, and one in Drawing. He has also given personal attendance in the drawing rooms daily, from 10 A.M. to 2 P.M., in case students come to the drawing rooms during those hours, and always during the afternoon hours from 2 P.M. to 4 P.M. Much of the time of the Instructor in Drawing is taken up in the morning in preparing subjects or plates and models for the students, and in recording the marks of the students, examining drawings, etc. Where there are sixty to seventy students at work daily this is quite a task.

Mr. R. E. Mayer, Assistant in Drawing, has been constantly present in the drawing room or near enough at hand for instant call during the hours from ten to four daily. He, in fact, has usually reached the School at 8.45 A.M., and has remained until some time after 4 P.M. During all this time, he has devoted himself faithfully to his duties, a part of his time having been occupied in making diagrams for lectures, by which a considerable saving is effected.

In addition to the duties above described and prescribed, and which are strictly accomplished, each professor is obliged to devote a certain portion of his time to reading examination papers, memoirs, or theses. For large classes this requires a good deal of time.

In my own instruction the solution of engineering problems constitutes an important part of the instruction; and such solutions cannot always be examined and criticised during lecture hours. This is a kind of extra work which is quite as important as lecture-room instruction. I do not think I spend less than eight hours (and often ten) each day of the college year exclusively and solely on the work of instruction imparted to me. I like the work, and do not complain. I believe I can conscientiously say that my work

is my pleasure, though I could not well devote more hours to it than I do now.

Respectfully submitted,

W. P. TROWBRIDGE,

*Professor of Engineering.*

Columbia College, April 19, 1886.

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DEPARTMENT OF ARCHITECTURE.

*To the President of Columbia College :*

During the past year, the department under my charge has followed much the same course as in the previous year, and there is hardly any thing to be said in regard to it which would not be, in substance, a repetition of my last year's report. Part of the work done during the summer vacation, however, was of so exceptional a character as to deserve special notice. The attention of some of the older students was attracted, towards the end of May, by public proposals put out by the authorities of the State of Colorado, asking for designs for a State Capitol, to be erected at Denver. It seemed to these young men as good a thing as they could do, in their first leisure, to make a set of drawings in competition for this work, and as the problem was an interesting and instructive one, and the building of a much more monumental character than they were likely to have, at present, any other chance of designing, I strongly encouraged the enterprise. Others soon became interested in it, and before the work was done nearly a dozen had taken part in it, six or eight of whom worked upon it very seriously, day and night, for five weeks. The result was extremely creditable in every point of view, the scheme being very intelligently conceived, the details well studied, and the execution of the drawings workman-like and careful. I was glad to accept a part of this performance in lieu of the work required to be done during the vacation.

The plan of commencing the more strictly technical and professional work of the department in the middle of the first year, instead of waiting until the beginning of the second, which had a partial trial a year ago, has this year been formally adopted with excellent results. The class have been practised in the elements of Architectural Drawing, including Shades and Shadows and Perspective. This not only saves valuable time next year, but enables them to use their summer to better advantage.

There have been during the year thirty students under my charge, all but two of whom have continued to the end of the year. Besides these, there have been, as was the case last year, several students belonging to other departments of the School, who have obtained leave to attend some of the exercises, much to my satisfaction.

Respectfully submitted,

WILLIAM R. WARE,

*Professor of Architecture.*

Columbia College, June 1, 1886.

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## REPORT OF INSTRUCTION IN BIOLOGY AND HYGIENE.

*To the President of Columbia College :*

During the year just past I have given two courses of ten lectures each, to the students of the Third Class in the School of Mines. These lectures have been devoted to the laws of life, more especially in their applications to human physiology and practical hygiene, and included instruction in first help in accidents, the ordinary causes of disease, and especially the relations of micro-organisms to this subject, and the consideration of problems in disinfection, ventilation, food supply, water supply, sewerage, etc. The lectures were illustrated with models, apparatus, and diagrams, and were well attended.

Dr. Alexis A. Julien has given instruction in microscopy to those students of the Second Class who are taking the



special course in Chemistry, four hours each week being devoted to this subject.

Respectfully submitted,

JOHN S. BILLINGS,  
*Lecturer on Hygiene.*

Washington, D. C., May 28, 1886.

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### *INSTRUCTION IN MICROSCOPY AND BIOLOGY.*

*To the President of Columbia College:*

I have the honor to report that I assumed charge, last October, of the class in Microscopy and Biology, consisting of twenty-two students of the Chemical course, Second Year. The course of lectures on Sanitary Engineering was delivered by Dr. Billings, while the duties assigned to me consisted of practical laboratory instruction in the studies above mentioned. The proper rooms for this purpose had yet to be selected and fitted up with the necessary furniture and apparatus. Two rooms were obtained in the northwest wing of the old central building; the upper one, in the third story, as a laboratory for the necessary chemical work, photomicrography, and store-room; the lower, for class instruction. The latter was too dark for microscopical work and needed the cutting out of two blind windows in the north wall, the introduction of gas and water, and other smaller changes. With the exception of some new stools, all the furniture of the two laboratories, and nearly all the materials for the alterations, were obtained from old articles, found unused in the college buildings and only needing repairs. These alterations were finished about the middle of January and have turned out entirely satisfactory for all our present needs. The instruction room, though small, has been a very pleasant one and quite sufficient for our newly-established course; and while larger quarters will be needed hereafter, the present room will still remain well fitted for biological study by advanced students, especially in the direction of bacteriological investigation.

During the three and a half months which elapsed before the alterations were completed, the insufficiency of light compelled me to alter my proposed plan of instruction, in order to protect the eyesight of the students of the class. Much inconvenience and lack of ventilation having been caused, during the first session, by keeping so many persons two hours at a time in a room of this size, two more hours per week were assigned during the second session, and the class was divided into two sections, using the room on separate days. The students were also encouraged to use the room at other times, and many have done so on the other days of the week. The desirable course of study was found to be far too extensive to compress into a single year, and, under the advice of Dr. Billings, was separated into two branches, Microscopy and Biology, attention being paid mainly to the former during the present year. While it is to be regretted that the delays and inconvenience experienced before the alterations were completed, served three or four students as an excuse to attempt to shirk the work required, I am glad to state that the general interest as well as the acquirements of the class, within this limited time, have been most gratifying to me. As the students this year were all members of the Chemical Course of the School of Mines, the chemical applications of the Microscope and the preparation of chemical mounts have so far received chief attention.

In conclusion, therefore, I would make two suggestions:

*First*, the need of a subdivision of our course of study into two years: Microscopy for the Second-Year chemists, and Biology for the Third-Year students.

*Secondly*, the probable need of an additional larger room, for the proper instruction of the increased number of students from two classes, during the next college year,

Very respectfully,

ALEXIS A. JULIEN,

*Instructor in Microscopy and Biology.*

Columbia College, May 20, 1886.

REPORT ON GEODESY AND PRACTICAL ASTRONOMY.

*To the President of Columbia College :*

I have the honor to report in regard to the work in the Department of Geodesy and Practical Astronomy in the School of Mines :

(1) *The Fourth Class* (10 students) has met me once a week in Geodesy. The lectures have been on the following subjects: Trigonometric levelling; sextant for time and latitude; transit instrument for time observations; zenith telescope for latitude observations; longitude; azimuth; L. M. Z. formulæ; method of least squares in its application to Geodesy; pendulum determinations of gravity; magnetic observations.

(2) *The Third Class* has met me twice a week in Astronomy and Geodesy. The class numbered twenty during the first term and thirteen during the second. The first term was given to instruction in Astronomy by text-book and illustrated lectures. During the second term the subject of Geodesy has been developed.

(3) A section of twenty students in the Third Class in Mechanics, has been instructed by me, attending twice a week, except at such times as when Prof. Peck lectured to the whole class.

(4) Mr. Rich, who was last year a post-graduate student in practical astronomy has become an advanced student at the Johns Hopkins University.

Respectfully submitted,

J. K. REES,

*Prof. Geodesy and Practical Astronomy.*

Columbia College, May 31, 1886.

**APPENDIX C.**

**SCHOOL OF POLITICAL SCIENCE.**

REPORT BY THE SENIOR PROFESSOR.

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*To the President of Columbia College:*

The students in the School of Political Science have received instruction in all the subjects contained in the schedule of studies to be found in the Handbook of Information of the School for the present year, for the number of hours per week, and, with one exception, by the persons therein described and designated. The illness of Professor Alexander has deprived the School of his valuable instruction since the beginning of December. Dr. Butler continued the instruction in Professor Alexander's subject to the end of the first semester faithfully and successfully. During the second semester, Dr. Edwin R. A. Seligman has discharged the duties of this department with marked ability and success. A report from Mr. Seligman is appended.

The attendance upon the courses of instruction given in this School has been, during the present year, about forty per cent. greater than ever before.

The greatest need which we feel at present in the School of Political Science is for more books. We do not yet possess a tithe of the literature upon the subjects taught in this School necessary to make our collection even approximately complete.

During the present year, the Faculty of the School have established a literary organ in the form of a Quarterly Magazine, which has met with fair reception and encouragement.

Through the generosity of Mr. Jesse Seligman, four fel-

lowships, of the value of two hundred and fifty dollars each per annum, have been, during the present year, established in this School. Also an annual prize in Political Economy by Dr. Edwin R. A. Seligman, of the value of one hundred and fifty dollars.

Respectfully submitted,

JOHN W. BURGESS,  
*Professor of History, Political Science, and International Law.*  
Columbia College, June 1, 1886.

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DEPARTMENT OF POLITICAL ECONOMY AND  
SOCIAL SCIENCE.

*To the President of Columbia College :*

I have the honor to submit the following report of instruction given during the last year in this department :

The First-Year Class has listened to lectures four times a week on historical and practical Political Economy, including the subjects of Finance and Taxation. Special attention has been devoted to the economic and financial history of the United States, and to the economic problems of the present, such as the silver question, railroad management, labor difficulties. etc.

The students of the Second and Third-Year classes have together listened to lectures on Statistical Science, Methods and Results, twice a week for one half year.

Finally, Dr. E. R. A. Seligman, the newly-appointed Prize-Lecturer, has delivered a course of lectures on the History of Political Economy, twice a week for one-half year, to the Second- and Third-Year classes.

Respectfully submitted,

RICHMOND MAYO SMITH,  
*Professor of Political Economy and Social Science.*  
Columbia College, May 29, 1886.

*REPORT ON INSTRUCTION IN EUROPEAN LAW.**To the President of Columbia College :*

I have the honor to make the following report upon my work in the School of Political Science during the year 1885-86.

I have delivered five lectures weekly upon the history of European Law (Roman, Canon, and Germanic), and upon the principles of modern civil jurisprudence. The sixth hour assigned to these subjects during each week was devoted to review and examination. About twenty-five students followed the course throughout. Twelve pursued successful examinations for the degree of M. A.

Readings from Gaius and the Digest were given during the months of February and March, two hours weekly. This course, which was completely optional, was attended by six students.

Respectfully submitted,

MUNROE SMITH,

*Adjunct-Professor, Lecturer on Roman Law.*

Columbia College, June 8, 1886.

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*DEPARTMENT OF ADMINISTRATIVE LAW.**To the President of Columbia College :*

During the past year, five lectures a week have been given on Administrative Law, in the School of Political Science. During the first session, the subject treated was Governmental Organization. The organization, both central and local, of the United States, as well as of the principal countries of Europe, was discussed. In the second session, the lectures were upon the relations of the government and the individual, embracing such subjects as public finance, the police power, governmental control of industry and commerce, and the remedies which are offered by the law to the

citizen against arbitrary action on the part of government officers.

I am, yours respectfully,

FRANK J. GOODNOW,  
*Lecturer on Administrative Law.*

Columbia College, May 31, 1886.

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DEPARTMENT OF PHILOSOPHY.

*To the President of Columbia College :*

The work of the department of Political Philosophy began, so far as I was concerned, at the commencement of the second term. During this term two lectures a week have been delivered to the students of the first year in the School of Political Science. Pursuing the course at the point where Professor Alexander had discontinued, I lectured on the theory of the Roman State and the doctrines of its philosophers and jurists; on the theories of the mediæval state in England and on the Continent; on the genesis of the modern doctrines in England, France, Germany, and Italy; and closed with the political theories of the French and American revolutions.

Respectfully submitted,

EDWIN R. A. SELIGMAN,  
*Lecturer.*

Columbia College, May 21, 1886.

**APPENDIX D.**  
**SCHOOL OF LAW.**

REPORT FROM THE WARDEN.

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*To the President of Columbia College :*

The Warden of the Law School would respectfully report as follows :

The attendance of the students and their devotion to the studies assigned to them by the statutes have been highly satisfactory. The Senior class has pursued the rules of Equity Jurisprudence under Professor Lee, and the topics of Evidence, Torts, and the Code of Procedure under Professor Chase. In the topics of Shipping and Insurance, they have been instructed by Professor Dwight. They have also had under him a review of the law of Contracts. They have been reviewed by Professor Lee in the law of Real Estate. Professor Ordranax has delivered his regular course of Lectures in Medical Jurisprudence, and Professor Chase a course of voluntary lectures in Criminal Law.

The Junior class has studied under Professor Dwight the general outlines of Municipal Law, and more particularly the law of Contracts, and under Professor Lee the law of Real Estate.

Each class has been divided into two sections, so that the professor in charge has been obliged to conduct two exercises each day on the same subject.

The Moot Courts have been conducted with much spirit on the part of the students. These exercises are in a high degree beneficial, and contribute greatly to bridging over the distance between the work of the class-room and the business of professional life.

The number of students in the Senior class has been one



hundred and forty-seven ; in the Junior class, two hundred and five. The graduating class of 1885 numbered one hundred and twenty-nine. Forty-four literary colleges are represented among the students of this school.

The first, second, and third prize tutorships, filled by the appointment of Mr. James M. Gifford, Mr. Charles E. Hughes, and Mr. Robert G. Petty, have proved highly useful, and have more than justified the expectations which I entertained of its success in recommending the adoption of the tutorial system. They have been attended by the students in regularly increasing numbers. Mr. Petty has instructed the students in the rules of Common-Law Pleading. Mr. Isaac L. Rice has acted as instructor in the preparation of legal briefs and the use of legal decisions, and has performed his duties with satisfaction to the students and credit to himself.

Respectfully submitted,

THEODORE W. DWIGHT,

*Warden of the Law School.*

Columbia College, April 29, 1886.

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DEPARTMENT OF CONSTITUTIONAL AND INTERNATIONAL LAW.

*To the President of Columbia College :*

The Department of Constitutional and International Law in the Law School begs to report that the usual instruction prescribed by the statutes of the Trustees has been given by the Professor in charge, viz., three hours per week throughout the year to the Junior class in the Constitutional Law of England, France, Germany, and the United States, and two hours per week throughout the year to the Senior class in International Law.

Respectfully submitted,

JOHN W. BURGESS,

*Professor of Constitutional and International Law.*

Columbia College, May 20, 1886.

**APPENDIX E.**

SCHOOL OF MEDICINE.

REPORT BY THE SECRETARY OF THE FACULTY.

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*To the President of Columbia College :*

In behalf of the Department of Medicine, I have the honor to report as follows :

The corner-stone of the new College building, given by the late William H. Vanderbilt, was laid by his son, George W. Vanderbilt, Esq., upon April 24, 1886, with appropriate ceremonies.

Upon this building work is going on so fast, that it is confidently hoped that the session of 1887-88 will be held therein, with full realization of immensely increased facilities for teaching and research.

It is with gratitude that the authorities of this department have to report that the gift of William H. Vanderbilt has received splendid additions since his death from the generosity of his family.

Upon a portion of the land given to the Medical School there is now in process of erection the "Sloane Maternity Hospital of the College of Physicians and Surgeons," the gift of William D. Sloane, Esq., of New York, whose wife, a daughter of the late Mr. Vanderbilt, has endowed the same, by making all of its thirty beds free in perpetuity.

This hospital will be ready to receive cases, and to give instruction, in the spring of 1887.

Its service will be under the direction of the Professor of Obstetrics of this College. Its resident staff will be appointed from among the graduates of the same, and the

members of the graduating class will be required each to attend therein a certain number of cases of midwifery.

Upon still another portion of the land given to the Medical School, close to the latter and to the Sloane Maternity Hospital, work is soon to be begun upon the building of the "Vanderbilt Clinic of the College of Physicians and Surgeons," given and endowed, at a cost of \$250,000, by the four sons of the late William H. Vanderbilt as a memorial of their father.

This building is to contain a Dispensary and every thing required for the reception and treatment of ambulant patients, together with a lecture-room and ample accommodations for the instruction of small classes in the practical diagnosis and treatment of all kinds of cases.

All the clinical instruction of this College will be given here, while the building of the Medical School proper will be devoted to didactic and laboratory teaching and to research.

The number of matriculants for the calendar year 1885 was five hundred and two.

Of these, one hundred and seventy-three (34.46 %) were, on matriculation, possessed of degrees, as follows:

A.B.....	87
A.M.....	10
S.B.....	13
Ph.B.....	12
M.D.....	39
M.B.....	1
G.P. (Graduate in Pharmacy).....	10
B.C.S. (Bachelor Chemical Science).....	1

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Individuals possessed of more than one degree are counted once only.

In September, 1885, there were examined for the degree of Doctor in Medicine, twenty candidates.

Of these, 15 passed; 5 failed to pass; percentage of failure, 25.

In April and May, 1886, there were examined for the degree of Doctor in Medicine, one hundred and eight candidates.

Of these, 82 passed; 26 failed to pass; percentage of failure, 24.

Matriculates, 1885..... 502

Graduates, 1885-86..... 97

Percentage of matriculates for 1885-86 who received the degree of M.D., 19.32.

Very respectfully yours,

JOHN G. CURTIS, M.D.,  
*Secretary of the Faculty.*

REPORT ON THE LIBRARY.

**APPENDIX F.**

*REPORT ON THE LIBRARY.*

BY MELVIL DEWEY, CHIEF LIBRARIAN.

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*To the President of Columbia College :*

Owing to the change in the college fiscal year and the vote that a report should be made with the annual estimate in December, I last year reported a few facts with reference to the later report. It has since seemed best to make the annual reports at the close of the fiscal year. The December report was not printed, and the present report therefore covers two entire years.

To this report is appended the annual Library Circular of Information just printed. In its forty-five pages is much information properly included in the annual report, but to save reprinting, it is here referred to and treated as an appendix.

When the library was reorganized, I proposed that we should attempt the general cataloguing, arrangement, numbering, etc., of the 50,000 vols. in the first three years, besides carrying on the regular work. To do this involved unusual efforts, but it is gratifying to find at the end of these three years that we have more than kept up to our initial estimates. Instead of closing the library, in order that this work might be done without confusion and extra labor, we have chosen the added burden of working at a serious disadvantage, rather than deprive the college of the use of the books for even a single month. The gain in usefulness has been worth what it cost, but it has distorted the apparent cost and labor of putting the library into proper condition, as in many cases

we have been forced to handle and move the same books four or five times instead of once only. We estimate that hereafter, now that we have practically caught up, we can do the same work at less than three-quarters the cost. Bearing in mind, therefore, that thus far we have been seriously handicapped, the amount and quality of the work done is more than satisfactory.

For convenience of reference I shall hereafter make my report under the heads used in classifying Library Economy, as given on pages 39-41 of the library circular appended.

**The Library's Place in the University.**—The library is the real university of the future, not simply for the people, but for scholars. Paul sat at the feet of Gamaliel; and in the academy, the lyceum, and the porch, the pupil was continually with the master; but the printing-press has changed all this, and to-day many an earnest disciple has never seen the face nor heard the voice of his master, but has received his teachings entirely through the printed page.

Of late years the college library has been taking an entirely new position. Of old it was usually attached to the chair of some overworked professor or put in charge of the janitor and opened four or five hours per week in term time only. Now it is being raised to the rank of a distinct university department. There are professors of bibliography, of books and reading, and at Columbia we have for the first time a chair of Library Economy. The libraries are being made as accessible as the traditional college well, some of them opening from 8 A.M. to 10 P.M.; including all holidays and vacations. They are receiving endowments—*e. g.*, the million and more to Cornell University, Prof. Horsford's great gift to Wellesley, Judge Packer's half million to Lehigh, and the long list of funds given to Harvard, the Phoenix gift to Columbia, and so I might go on with hundreds of illustrations. New and beautiful buildings, some fire-proof, all vast improvements over what was thought sufficient in the last generation are going up—*e. g.*, Harvard, Amherst,

Dartmouth, University of Vermont, Oberlin, University of Michigan, and so on. In New York City alone three splendid collegiate library buildings have just been finished; for the General Theological Seminary, Union Theological Seminary, and our own at Columbia. The colleges are waking to the fact that the work of every professor and every department is necessarily based on the library; text-books are constantly yielding their exalted places to wiser and broader methods; professor after professor sends his classes or goes with them to the library and teaches them to investigate for themselves and to *use* books—getting beyond the method of the primary school with its parrot-like recitations from a single text. With the reference librarians to counsel and guide readers; with the greatly improved catalogues and indexes, cross-references, notes, and printed guides, it is quite possible to make a great university of a great library without professors. Valuable as they are in giving personal inspiration, they can do little in making a university without the library. Just as truly as we find in popular education that the real school for the mass of people and for all their lives except early childhood is the library, so in the higher education the real university is a great library thoroughly organized and liberally administered.

Fortunately our students, faculty, trustees, alumni, and the public are all at least beginning to recognize this proper claim of the library as the essential foundation for all university work. It is not one of the departments struggling for its full share of attention and financial support, but is a co-worker with each and a rival to none. It is more and more apparent that the future of Columbia, however excellent its undergraduate department may be, is to be on the university side. Whatever difference of opinion there may be as to the advantages of city or country for the college, there is practically agreement that for a university the metropolis offers unequalled advantages. We should therefore look forward to attracting each year a larger number of the graduates of other colleges to Columbia by offering

them facilities not to be excelled at home or abroad. In this university work the library must take the leading place, as these graduates, except those in the scientific laboratories, spend most of their time in the library, which, under the present methods, has come to be their laboratory as truly as that of the adjoining building is that of the chemists. We should not hope to maintain our present position in science, even though we retained all our eminent professors, if we failed to provide amply the best facilities for constant laboratory experience. No more can the eminent scholars in all our other departments attract students from the advantages offered at other leading universities unless the library fully provides books and the best facilities for using them. As soon as scholars agree that, by means of its improved methods, conveniences for readers, minute classification, analysis and cataloguing, and the various aids to readers which we are providing, the Columbia Library enables them to do more work in a given time than any other, we shall see a growth of our university departments that will amply repay for the labor and money which the trustees are so wisely giving us.

The rapidity with which this idea of the University Library is growing here gives great hope for our future. The press has many times, in the past two years, lent its assistance. Prominent scholars and university men more and more frequently avail themselves of our privileges, and give their hearty sympathies and cordial words of encouragement and approval. Our alumni were reminded by our action in giving them the full library privileges of undergraduates that they are still Columbia College men, and in no other department has so much cordial interest been manifested as in the library. Their personal visits are many fold more frequent and appreciative, and letters constantly vouch for this growing feeling. We have thrown the library open to visitors after all the alumni reunions, lectures, and other meetings on the grounds, and a great number have expressed surprise and delight at the facilities offered, the progress made, and the promise for the future.



**Important Gifts and Growing Interest.**—Each year we have repeated the successful experience of 1884 in clearing the main hall of tables, and giving it up for the senior Class Day. The count at the door recorded nearly 1,500 people as present. The library staff were scattered about the building, so that close supervision was possible if necessary, but neither year has there been any interference with books or any thing else to merit criticism. As I suggested in my last report, this liberal action has resulted in direct and immediate gain to the library, besides adding greatly to the pleasant associations which our graduates carry away from academic life. The class of '85, School of Arts, as part of their Class Day exercises, unveiled a beautiful memorial window admirably reproducing the famous picture of Sophocles standing before a marble temple. It contains about sixty feet of stained glass made by Louis Tiffany & Co., of New York, and is at the left of the west fireplace in the great reading-hall, to the beauty of which it so greatly adds. This Greek window is the first in a series planned by the chief librarian, and by vote of the committee to be accepted as classes or individuals interested may offer them. The light of our main hall was found so great from its sixty-three large windows on all four sides that it was necessary to reduce it on the south. Here eight double windows, each having two lancets fifteen by three feet, face the main entrance. The plan proposed maps out the general classification of the library by assigning these windows to our great divisions of literature, viz.: American, English, German, French, Italian, Spanish, Latin, and Greek. In each is to be placed a stained glass window with leading authors or something representative of the literature. This allows large liberty in selecting the subject for each window. Already graduates of three other classes have announced their hope of giving one of these windows, and certainly there is no equally fine opportunity on the college grounds for a beautiful memorial.

By the generosity of Messrs. Lloyd and Phillips Phoenix we have received a beautiful oil portrait, by Lazarus, of

their brother Stephen Whitney Phoenix, Columbia's greatest benefactor. This has been placed over the Phoenix Library, in one of the upper galleries reserved for the portraits of those who make endowments.

The library is about to complete its series of portraits of the presidents of the college by that of the present incumbent, under whose administration since 1864 its great development has taken place. This is now being painted by our leading portrait artist, Eastman Johnson.

Fine marbles of President Barnard and Professor Torrey and an oil portrait of Professor Samuel Mitchill, the founder of the New York Academy of Sciences and Professor of Natural History, 1792-1801, have been added, besides many minor works of art and historic interest which find their most fitting home in our new fire-proof building, so constantly open to all interested.

An incidental sign of growing interest is found in the demand for pictures of the library. During the two years over one hundred different photographs have been taken. There has just been published by the Library Bureau, Boston, a series of twenty-three Columbia College Views, by the Photogravure Co., ten of which are of the library, which gives those interested better pictures at one fourth the former cost. The wide distribution of these excellent pictures will certainly help to stimulate general interest.

Repeated requests have been made for the use of the library hall for lectures, but the committee have found it inconsistent with its design as a reading-room, always open, to close it except on the one day granted to the senior class. This year the chapter of *Φ. B. K.* had its annual address on the evening of Class Day, thus making it possible to use the library for that purpose. A large audience listened to General Stewart L. Woodford, and afterward improved the opportunity to inspect the various college buildings.

The most direct effort to stimulate interest has been the publication of an appeal, by the trustees to the public for

money and books for the university library (see circular, pp. 21-22), and the longer and shorter appeals as printed by the trustees. There has been evidence that these appeals were wise and timely. No sudden influx of gifts was expected, but there is proof that in many minds the needs of the college are now clear, with a disposition sooner or later to share in supplying them.

Our list of gifts shows how many books and pamphlets, some of them among the most valuable in our collection, have already been sent us. In January Hon. A. A. Low, at the suggestion of his son, Mayor Seth Low, of Brooklyn, one of our trustees, gave us \$5,000 to be spent at once for books most urgently needed. The over 3,000 volumes that bear Mr. Low's name have been indeed a blessing to us this year, for the demand has kept pace with our rapid development, and the need is urgent for large additions in many directions.

Another trustee, Mr. F. Augustus Schermerhorn has just made us a most practical gift, in carpeting all the galleries and aisles so that the annoyance from the noise of hundreds of feet is removed. This valuable gift includes nearly 300 yards of carpet put down with brass sockets and pins so that it can be readily removed and cleaned.

At the last meeting of the trustees I sent in a check for \$100 from Mr. W. A. White, President of the Brooklyn Library, in this practical way expressing his appreciation of what we are trying to do in increasing the library facilities of New York.

Mr. J. F. Loubat has given us books and plates which cost over \$20,000 and which will enable us by exchange to secure many valuable works not regularly offered for sale, and in other ways has expressed an interest in our work which lays us under great obligations.

The Class of 1886 at its Class Day made a most practical gift in a Memorial Library of American Belles-lettres spending the entire fund at once and making the books available, rather than investing it for small annual additions. This adds about 500 choice volumes, and fairly fills out the

better class of American literature. These were much needed for the study of American authors, and will also be highly appreciated by many officers and students who have often deplored our lack of books adapted to an hour's refreshment after severe studies.

The Class of 1882 has already given notice that at the fifth anniversary of its graduation, next commencement, it will endow some subject yet to be selected with a class memorial fund, the income of which shall forever be used in keeping up that department. Other classes and individuals are considering similar endowments, and our plan to make permanent provisions for important subjects in our university library, as all colleges aim to do for their leading chairs, by special endowments, seems fairly though very modestly started. Both the appeal and the circular appended point out the advantages of this plan for one interested in any subject and, wishing to do for it the most possible with a given amount of money.

I give the resolution put on record by the committee on the library as showing their willingness to encourage these much-needed endowments.

*Resolved:* That the efforts of the chief librarian to secure endowments for special departments of the library be heartily approved, and that he be authorized to agree, in behalf of the committee, that sections of the library so endowed without objectionable restrictions may be named by the giver, that suitable inscriptions shall be placed over the books, and that a special book-plate shall be prepared and put in each volume so given, and if necessary a separate catalogue of the books shall be kept.

For those less interested in books than in art, our waiting windows mentioned above, the vacant panels for fine pictures, and the two great fireplaces in the main hall, for which admirable designs are already made, offer most attractive objects for their generosity. Among other pressing needs which we hope may yet be supplied by friends are added tables and desks for special students and suitable locked glass cases for the display of our choice collection of

rarities now locked away from visitors for lack of such accommodation.

Another source of valuable additions is the gift or, what amounts to the same thing, the permanent deposit with us of the special collections of certain societies. We have already thus received the entire collections of the American Metrological Society, the American Library Association, the Peithologian Society, the Philolexian Society, the Torrey Botanical Club, and some smaller gifts. The N. Y. Shakspeare Society proposes to make a similar deposit. During the present summer we also receive the very valuable library of the N. Y. Academy of Sciences, containing some 8,000 volumes, many of them being transactions of scientific societies not now in the market at any price.

As illustrative, I append the resolution of the American Library Association. At Cambridge, Oct. 29, 1884, the following resolution was unanimously passed and under it the collections have been turned over to the college.

*Resolved*: That the offer of Columbia College Library to accept the collections of the A. L. A., store them in its fire-proof building, classify, catalogue, and index the same, and hold them open for the inspection of any members of the A. L. A. from 8 A.M. to 10 P.M. throughout the year, without charge to the A. L. A., on condition that the collections shall be permanently deposited in the Columbia College Library without the right of withdrawal, be accepted, and that the Secretary be directed to turn over the collections to the Columbia College Library.

The most important acquisition of the year has been the Townsend Civil-War Records now deposited in the east end of the main reading-room. This now justly famous record has cost twenty-five years of Mr. T. S. Townsend's time, besides over \$20,000 paid for clerical labor, and the work is still going forward. At the beginning of the Civil War all the New York papers were taken in duplicate, with the idea that the firing on Sumter would prove a most interesting historical episode and that every thing pertain-

ing to the subject should be preserved. Besides these papers other leading journals were laid under contribution, and each day a great scrap-book was kept up of that day's history. Having undertaken this work it was kept up till the close of the war and then through the period of reconstruction. The main record is for the ten years, but to it has been added all the important matter bearing on that period that has since appeared, *e. g.*, the many recent war papers, the accounts of Gen. Grant's death and funeral, etc. This great work now equals 1,000 printed 8° volumes, but the Digest which makes it all available has cost vastly more than the Record itself. In this, under an elaborate classification to which there is a full index, is given a concise summary of all that the Record contains about each battle, regiment, officer, or prominent man, place, or event. Together the Index, Digest, and Record enable one quickly to get at a wealth of information and detail absolutely unobtainable elsewhere, and the highest authorities have after examination pronounced the work not only unique but invaluable and a necessity to one writing on the history of the period. It is matter of congratulation that this work of national importance has been deposited in our fire-proof building and we expect that it will draw to the Library students of history who will feel it essential to consult this wonderful record.

As was predicted when we opened the library day and evening throughout the year, societies and individuals owning specially valuable collections, recognize the advantage of having them in a fire-proof building in so central a location with so many conveniences for use, and such deposits are clearly greatly to the advantage of both the depositors and the college. In the same way foreign governments and societies have recognized our claims as the best, where only one or at best only very few copies of important works could come to this country, and we are receiving an increasing number of gifts due to the liberal position we have taken.

These gifts have by no means flowed in upon us without efforts on our part. We have kept up a correspondence at home and abroad that is constantly increasing, and the large

number of gifts of special value is due chiefly to this personal and persistent effort on our part.

**Building.**—On page 30 of my first report I called attention to the fact that the almost invariable mistake in library buildings had been repeated here, as there was no adequate provision for the future growth of the collections. I also added that an entirely satisfactory remedy had been devised. During the past two years this new plan has been submitted to a large number of experienced librarians and others interested, and it has been uniformly accepted as the best possible solution, and in itself satisfactory in the highest degree, although not in mind when the present building was erected. The first two floors of this building, now occupied by the Law School, were intended for the growth of the library, space being left for a new Law building on the north side of the Arts quadrangle. While these floors are most admirably adapted for the Law School, for which they were expressly designed, they could be used for library purposes only with great waste of space or very extensive and expensive alterations. The accommodations being ample and satisfactory for the Law School, it would be positive extravagance to undertake their conversion to library uses. For the same money that it would cost to make these changes and to provide a new building for the Law School we can erect a fire-proof stack with more than five times the capacity for storing books.

The only possible direction in which the present costly building can be extended is on the north side, over the ground of the old chapel. This lot, 42 x 92 feet, is, for the city, remarkably well adapted to a library stack, as every alternate sixth of its entire perimeter will always be fully open to the light from foundation to roof. On this we could build a fire-proof building divided by an east and west wall near its centre, so as to make two tiers of four lecture-rooms, each of the eight rooms about 12 meters (40 feet) square and 5 m. (16 feet) high, with two more similar rooms on the first floor, 3 m. (10 feet) high, and two more on the top floor of about the same height. The floor level

of the third and fifth floors would exactly correspond to those of the third and sixth floors in the library—*i. e.*, the main reading-hall and the botanical room. The details of lighting, stairs, etc., all work out satisfactorily. The great merit of this plan is that it allows the college to use for other purposes all the rooms not actually required by the library, vacating the twelve rooms one by one only so fast as the demand for shelving or added space for readers' tables made it absolutely necessary. Almost invariably a building must be erected sufficiently large to provide for the future, and it is impracticable to make any other use of it. As a result, if space for the growth of fifty years is provided, only one fiftieth of it is used during the first year, two fiftieths the second, and so on, though the expense has been incurred for the whole. Thus averaging the fifty years it costs double to provide storage for the books during the period of accumulation. Under our plan, the library would take one of the twelve rooms the first year, the other eleven being occupied by the college. As soon as the first room was filled the second would be taken by the library, so that no portion of the building should stand idle, and yet ample provision would be made for a long and rapid growth. In each of these fire-proof rooms, when occupied by books, a skeleton floor could be placed midway, thus giving two tiers of books each eight feet high. By the rule that each square meter of floor space will hold in stack a third of 1,000 average volumes, we get an aggregate capacity in the new building of 1,000,000 volumes, for the rooms being about  $12 \times 12\frac{1}{2}$  meters, measure 150 square meters, and the skeleton floor doubles the space, thus giving us 300 square meters, or 100,000 volumes to each of the eight rooms with 5 m. ceilings. The first and sixth floors having lower ceilings would have no extra floor, and so altogether would make up 200,000 volumes. This plan carries the library through from 49th to 50th streets, and we should secure the ideal arrangement, perhaps never before so completely attained, for our building would perfectly illustrate the central theory so much in favor for a library. Our block is almost exactly in the cen-



tre of the city on north, south, east or west lines ; our building is in the centre of 'the block, and would have north-south, east, and west entrances evenly distributed. The main entrances would meet in the exact centre of the building at the present entrance to the main reading-room, where we now have our Loan Desk and the executive office of the library. Finally, as the new stack would have three floors and a basement below this level and seven floors above, the Loan Desk would be central on perpendicular as well as horizontal lines. Our present building, erected at so great cost, works in perfectly as a part of this system, and its only defects are entirely obviated by the present plan, which affords not only needed room for the storage of books and accommodations for the growing number of readers, but the various administrative rooms which the present building almost entirely lacks. Fuller details and estimates can be seen in ms.

Iron doors have been placed at the only point where the library connects with the old buildings, thus completing our protection against fire. The thoroughly fire-proof construction of the building, the frequent visits to each room of the night watchman, and the precautions taken with the heating, ventilating, and lighting apparatus seem to reduce the danger of fire to the very minimum. It is doubtful if any other city library is so thoroughly safe from this greatest danger.

Our main reading-hall was found to have the remarkable fault of being too well lighted, except on dark days, and we have, after an unsuccessful experience with shades, found a satisfactory remedy in giving all the south and east windows a grey tint. Continued use of the Edison electric light confirms our highest hopes as to its utility. We have many readers who bear testimony to its value in sparing delicate eyes. Some use it freely throughout the evening who are quite unable to read for any length of time by gas. When we remember that it gives off no appreciable heat and that being in a sealed glass lamp, absolutely no products of combustion are given off to the detriment of the books and

to render the air unfit to breathe, we feel that our decision was an eminently wise one. Since the last report additional connections have been made at several points; lights have been carried to the new catalogue cases, and all the stack rooms are now fully equipped with the electric lamps. The ease and cheapness with which wires may be carried to any desired point is another element in the unequalled convenience.

We have reduced the size of the radiator in one room, had new and larger ones placed in the office and the west end of the main hall, and now consider the heating apparatus equal to any reasonable demands. The ventilating apparatus has also worked very well; but it will be necessary to introduce some form of roof ventilator into the office, which is not connected with the regular system for either the delivery of pure heated air or for expelling impure air. By hinging the entrance-hall windows needed ventilation has been there secured.

**Government and Service.**—After further trial it was found desirable to modify the organization of the Committee on the Library, for with the work broken up among so many sub-committees it was found that no one of them became very familiar with the details of library work. The two separate committees on the Library School and on College Publications were continued as before. The other five sub-committees and the new Auditing Committee were consolidated into a single Executive Committee of three, with power to act on all matters on which the committee and the chief librarian were agreed. Any member of the committee, or the chief librarian, may thus have submitted to the full committee any point on which there is doubt in the executive council. As a result the new Executive Committee, in performing the duties of all the former sub-committees, becomes vastly more familiar with all parts of the library, and is able to take prompt action on most questions that arise, without the delay of securing added information. The change has secured closer supervision on the part of the trustees and much greater dispatch. This

Executive Committee reports its action in writing to the full committee at each of its regular quarterly meetings.

**Examining Committee.**—In order to secure a thorough examination and written report each year from a committee interested in the library but outside the direct management, it has been

*Resolved* : That there be appointed each year an Examining Committee, consisting of two members of the Library Committee, with power to add to their number any person or persons. This committee, with the chief librarian, shall make a thorough examination of the library, including buildings, books, pamphlets, catalogues, methods of administration, expenses, records, statistics, regulations, facilities offered readers, and all matters pertaining to and in charge of the Library Committee, and shall report in writing the results of such examination, with any recommendations for improving the library or its methods, or for reducing its cost to the college.

The plan is that some of the alumni, professors, trustees, or others specially qualified or interested in us, will be appointed, thus giving each year the careful opinions of a new committee as to the condition of the library and its needs. This will be a safeguard against falling into ruts, and an assurance of double supervision.

**Auditing Committee.**—Great pains have been taken with our financial system to insure that the money voted to the committee by the trustees shall accomplish as much as possible for the college, and be hedged with every useful safeguard. Our appropriations are three : 1. Salaries, from which all services of librarians, assistants, cataloguers, pages, etc., are paid. 2. Books—from which all book, serial, and binding bills are paid. 3. Incidentals—from which all other bills except for salaries and books are paid. After the committee agrees what shall be bought or who shall be employed there are four examinations of all bills before they go to the Finance Committee for final auditing. The cashier at the library inspects every item and uses all the usual business precautions as if his work were final. Then the chief

librarian examines every item in detail independently. The bills then go to the Auditing Committee for their examination and approval. With these three examinations and approvals certified, they are sent to the treasurer, who again examines them and reports them finally with his opinion to the full Finance Committee, which, if it finds them satisfactory in every respect, orders their payment. It is evident that the danger of extravagance, overcharging, or errors is thus reduced to a minimum, but it has seemed best to err on the side of extra caution, and thus deserve the highest confidence from the trustees who vote us our annual appropriations.

**Faculty Committee.**—An important step has been taken in formally asking the faculties of the various schools to apportion among themselves the annual appropriations for books, thus transferring wholly to the professors the responsibility of the selection of books. This, in fact, has been the aim of the library since its reorganization, but this more formal action serves to emphasize our wish that each professor shall see to it that the best books on his subject are in our university collection.

Now that our catalogues are nearly made up, the time has come for a more active alliance between the library and the various schools, and I propose that a Faculty Committee composed of the president and the chief librarian *ex-officio*, and one representative from each faculty elected annually by ballot, shall hold regular meetings to consider general library interests, and to further the more direct co-operation of the library and the chairs of instruction as has been proposed. Such a committee would do much to develop and maintain close and cordial relations between each faculty and the library staff, and would be mutually and materially helpful. It would also be able to relieve the committee of the trustees of certain work which the professors who are constantly on the grounds and using the library could do much more readily and effectively than any possible committee less favorably situated.

**Staff.**—The frequent changes in the staff, when under-

stood, are matter for congratulation. After the first year, as our unusual facilities became known, we have received constant applications for positions from those caring less for the salary than for the opportunity to become familiar with our methods. As the trustees had sanctioned the principle in voting to open a training-school for librarians, the committee wisely decided to select from the many candidates the most promising, and give them opportunity for training in our library with a very low salary. With the same money appropriated for our work we have thus increased the staff in numbers. Calls are becoming more and more frequent from other libraries for assistants who have been with us, and as was hoped a considerable number have left us to accept higher compensations elsewhere. Their places have been filled in turn by other candidates, and thus the frequent changes in the staff are evidence of the success of our plan. We have already sent out four men and twelve women, not counting the eight pages and other helpers who have found the time spent with us valuable training. This does not count the considerable number who have spent a few days or weeks in studying our methods for adoption elsewhere, but who were not regularly on our staff of service. The number of libraries that have followed our leadership since my last report is very flattering to the methods adopted here. We have thus recognized and partially filled a new field in making the library the important factor in the education of its employés as well as of its readers. Certainly it is legitimate for a university, endowed and carried on solely in the interests of education, to give training and culture for the work of life in its library as well as in its class-rooms.

During the two years there have been weekly lectures or conferences, usually by the chief librarian, on various topics in Library Economy and Bibliography, and the staff have themselves maintained a club for mutual improvement in librarianship. All this is of course preliminary to our School of Library Economy to be opened next January, and for much fuller information regarding the plan and the

facilities to be enjoyed I refer to p. 23-45 of the Library Circular attached.

Notwithstanding the fact that our School is not opened, and that no notice has been given that we can supply help, the comparatively large number already sent out have not met the demand, and we still have calls unfilled. The two years have confirmed the belief that the Library School will fill a real want, and, while modest in numbers and pretensions, will be a most useful department.

Our staff has maintained a high standard of work and interest in our library that has caused much favorable comment. Observers tell us that nowhere else have they found so great a personal enthusiasm for the best interest of the institution. And yet the low salaries paid and the excellent service rendered have been no financial gain to the college, for, valuable as these are, we have given our assistants a full equivalent in the time and labor spent in their advancement and training for a higher position. The gain is to our pupil assistants and to library interests at large and not to the college directly, for here, as in the other departments, the education given costs much more than the tuition received. A public library supported by the public funds could not attempt this work, for it would be diverting to educational purposes the money given for books. Therefore this work must be done by us or some other university library, and the trial thus far amply confirms the wisdom of the trustees in accepting this view, and ordering the Library School to be opened after two years of this preparatory work.

Our force of five librarians was reduced by resignation of Mr. J. Herbert Senter, formerly of the Harvard College Library, who accepted a call to the Astor Library. It has been increased by the appointment of N. L. Britton, E.M., Ph.D., as Librarian in charge of the Botanical Library and Herbarium. The force of cataloguers with the end of this year has been materially reduced as we near the completion of our catalogues. On the other hand the reference and loan and general work has so increased with the growth of

the library and interest in it, that more help has been found necessary in these departments. Constant study has enabled us steadily to increase the average amount of work of a given quality from each assistant. We have fixed the hours of work and vacation to secure the best returns to the library, taking the year together. We require ten months of 200 hours each of actual work, all lost time for holidays or other absences being made up or deducted from the monthly payment. Deducting from the ten months required, Sundays, legal and college holidays, we have an average of about 250 working days, so that our rule might be put as eight hours per day for ten months, not working holidays. Some libraries, *e. g.*, the Boston Public, found after years of trial in their cataloguing departments, that seven hours per day was the limit of the best work, but we find that assistants in good health can work eight hours, and have provided that those not so strong may work shorter hours at a proportionately lower salary.

The rule established that members of the staff, willing to pay their own expenses to the annual meetings of the American Library Association, should be accredited as delegates, and be allowed the necessary leave of absence without deduction from salary, has proved a wise one. Those members who have availed themselves of it have clearly accomplished more for the library in the remaining time, because of the inspiration and enthusiasm for their work brought back from the meetings, and it has proved to be for our interests to encourage such attendance.

**Regulations for Readers.**—The rules so carefully examined and approved by our committee in our first year have proved satisfactory in use, except to the few lawless readers who, with the best of intentions, would ruin half the usefulness of the library if left without check. The spirit in which the rules have been received is commendable, and in repeated cases where complaint has been made, after a simple statement of the reason why the rule was found necessary, the person complaining has frankly expressed his approval of the rule, and willingness to help its enforcement.

We have tried to impress on all our readers that the sole object of the rules is to protect their mutual interests, and thus make the library more useful to the college as a whole, and that the convenience of the librarians is not considered when conflicting with that of the readers. Now and then an officer has expressed surprise or annoyance that any rule should be made for him, but most of our professors have recognized the spirit of the library staff, and believed our assertions that the rules have been found absolutely necessary for the safety and highest usefulness of the books. With the Faculty Committee proposed above, we hope we shall be able, without giving offense, to educate our professors to greater thoughtfulness. Not infrequently a class is strongly recommended to consult a certain volume, and a score of applications are made for it. Our records show that the professor has had, for six months or more, the only copy in the library, and perhaps in the city, and perhaps has long since made all the use he wishes of it. The complaint of the student, under such circumstances, is certainly just. On the other hand, other professors are not only careful not to withdraw the very books they are urging students to consult, but they have often loaned their private books also, or put them in their class-rooms temporarily, to give more students access to them. These difficulties can hardly be reached by legislation, but will cure themselves as professors and students recognize the library as their common laboratory, in which all should feel a scholarly interest in the greatest good to the greatest number, rather than regarding it only selfishly. This point is emphasized, not because our readers are more selfish than others, but because an improvement in this respect will accrue to the benefit of all, and is sure to be made as soon as its claims are clearly understood.

In enforcing the rules about fines, renewals, reservation of books, etc, the librarians subject themselves to the same rules and pay exactly the same fines, thus disarming criticism from others.

We are increasing the privileges granted readers as fast



as practicable, and our unusual confidence has thus far, been justified. Added shelves, containing over 20,000 volumes, have been freely opened, and while, as is inevitable, books are often misplaced, so that it takes the whole time of one page correcting the shelves, yet we believe the practical gain in usefulness fully compensates for the extra care and labor thrown upon the staff.

The Loan Desk being open earlier and later than any other part of the College, and also on holidays and vacations, has also inevitably come to be a kind of university convenience. Hundreds of telegrams, notes, letters and packages reach their destination more quickly through the Loan Desk, and hundreds of readers are accommodated with postage stamps, paper, pencils, college publications, etc. Details of the various new features introduced will be found on pages 9-12 of the Library Circular.

The provision for copying, short-hand, and type-writing and verified copies is appreciated by those who often wish a little service of this kind at a reasonable price. Without loss to the College, we are able to be of great practical services, specially to scholars out of town, or living at a distance.

The college lunch-room has been a great convenience to our readers, who have thus been able to avoid a serious break in the middle of the day for lunch. The check-room has been largely used and supplemented by a series of shelves for books and papers which readers use without checks. Thus far no case has been reported of any interference with these shelves, though they are open to all readers. We have been forced to adopt the usual rule forbidding readers from carrying bags into the library, not because of theft, but because a few students carried off books in their bags without charging, and kept them till quite convenient to return them in the same way. A similar recklessness comes up regarding our reference books, some of which are now and then taken from the building, to the great annoyance of other students who need them.

Four hundred and fifty-three readers' tickets have been

issued, one hundred and fifty-seven of them to ladies. Our list of honorary readers include the names of many well-known scholars in New York and vicinity. The plan has been a complete success, and has won us many warm friends, who have already sent us valuable gifts, and will remember us hereafter. Already we have learned of bequests of valuable private collections to come to us on the death of their present owners. As these readers come almost entirely evenings, holidays, vacations, and when students have begun leaving the grounds for the day, we do not find that it materially increases our need for more tables for readers.

The presence of ladies among our staff and among our readers, has had only a good effect, and all doubts as to its expediency were long ago dispelled. Many ladies who are pursuing higher studies, or making special investigations, have been grateful for their privileges, and we observe with pleasure that an increasing number come to read.

**Executive Department.**—In buying we have continued the plan noted on page fourteen of my last report. We have saved time, labor, and money by getting all our periodicals and foreign books through our foreign agent, G. E. Stechert, of 766 Broadway, N. Y., Hospital St., 10, Leipsic, and 26 King William St., Strand, London. We have thus secured weekly shipments and prompt delivery, and our serials have come flat and clean for binding instead of half ruined through the foreign mails with the attendant risk of occasional loss. All our American books we have continued to buy under a liberal arrangement with Chas. Scribner's Sons, 743 Broadway, N. Y.

Our stationery and printing, and a large line of technical library supplies which we require we have obtained at a saving of 5 to 30 %, and averaging over 10 %, by sending direct to the Library Bureau, 32 Hawley St., Boston, which devotes itself entirely to supplying libraries, and has offered us better articles at less prices than we were able to secure by competitive estimates elsewhere.

We have aimed to apply the same rules to our library

work that the successful business man observes. Wherever we could save more than the cost by labor-saving machines or methods we adopted them. As a result we have something like a hundred blank forms in use, for whenever we find that we have to write any form often enough so that printing is cheaper than clerk hire we immediately print. In this spirit we found on trial many places where newly devised machines have enabled us to do our work at less cost, and it is not improbable that with the stimulus of our Library School we shall have a series of inventions that in the aggregate will improve results and reduce expenses.

Bulletin boards have been provided for library and college notices, for each of the literary societies and for the Shakspeare and other societies meeting at the college. Also a board for the Lost and Found blanks, the Loan Desk again serving as a centre where every thing lost and found is reported and promptly bulletined on the special blanks provided.

With so large a constituency, certain losses will be inevitable, but we are grateful to escape with few. Our system of private marks, double charges, and other records is so complete that our library is a discouraging field of operations for book thieves. One fell into the snare during the year, but his detection and the recovery of the books from his room by a messenger from the library were so sudden and vigorous that he will doubtless choose elsewhere for the next depredation, if, indeed, the lesson taught him will not end his experience in collecting a private library on this system. We realized the extra danger to which we are exposed in a great city, and have taken all precautions for safety that seemed wise. Such losses as we can not prevent we must charge up to running expenses, and feel that the price is not too high for the greater privileges we are thus able to give our readers.

**Accession Department.**—The tables appended will show the additions. These include a large number of costly books and sets long needed by the college and recently added. That so many books, including these costly works,

have been bought with our funds is due to the low prices secured and our watch for second-hand copies and for needed books at auction, where we have secured them often at less than a fifth of their regular price.

We have hardly begun our systematic efforts to secure gifts, yet the number of friends who thus remember us is constantly increasing, and each sends us what he can. The list of gifts is very incomplete in pamphlets, as we have made no record of the thousands collected by ourselves or sent in by mail without indication of their source. Pressure in getting up the arrears of cataloguing has taken precedence of other desirable work. Hereafter we shall record the total received. The summary of our large list of serials is shown in the tables, and the detailed list will shortly appear in the Union List of periodicals taken in the libraries of New York and vicinity, which we have nearly ready for the printer. This will indicate by initials against each serial every library that contains it, and the type in which it is printed—roman, italic, or black face—will show whether it has current numbers, a partial set, or a complete set. Such a list will enable us to know at once the serial resources of all the New York libraries.

We are getting fairly started in collecting clippings of special value to the college, and our cheap and effective system of preserving them all will enable us to develop a most valuable collection.

We have also devised a series of bulletin boards with notes and queries for each main division of the library. Here those interested in the subject will find brief lists of the important additions and such notices, queries, or notes as will specially interest them.

The Inspection Shelves are more and more consulted by those who wish to keep abreast of the new additions. We have just divided these inspection books into our ten main classes, so that one interested, *e. g.*, in science, may see on a single shelf the week's additions to his department without having to look through the entire collection. Many improve the opportunity to read wholly or in part some of the

newest books during the week of inspection, as they may be freely used in the reading-room.

The Accession Book is also open to readers, and there one may see the additions of each day, or by glancing down the class-number column may see what books on any subject have been added during any given period.

**Growth.**—I append a table of the 50 leading libraries of this country, in 1876, by the United States Report on Libraries, from which it appears that Columbia College ranked 109th, but as we have now consolidated all the libraries into one university collection, I have given the total of all, including the Botanical collection. This gives us 49th place, or barely within the limit of the largest 50. Five years later the Encyclopedia Britannica made new statistics, and by these it appears that we had grown to 38th place. At the date of this report I made direct application to each of these libraries for figures corrected to July 1, 1886. We have now reached 17th place, or if we count the 8,000 volumes of the New York Academy of Science, about being moved in, our place is 16th. These are the 50 largest libraries as reported in 1876, and include some having no claim other than that report to a place among our leading libraries. Others with fewer volumes are more valuable and doing vastly better work. In my next report I shall submit a more useful and interesting list of the 50 libraries from which we may hope most. This will include some of our best collections founded or chiefly developed since 1876. I have appended the table to this report to show how satisfactory is the consolidation and growth, that in a single decade, has carried us from a rank in the second hundred to a recognized place in the first twenty libraries of this country. Our additions for this year are less than the average. In 1884 we added 13,889 volumes and 8,116 pamphlets, and in three years have increased over 30,000 bound volumes. As we have taken unusual pains in selecting these additions and have not counted the thousands of unbound volumes and pamphlets which we have put on the shelves, though most libraries count

every thing that is shelved regularly, it is evident that we are growing rapidly and healthfully, and have reason to be satisfied with our first three years which were assigned from the first to "getting ready" for regular work.

**Catalogue Department.**—We have exceeded our original estimate in the work done and may now claim to be fairly started, though there is still much back work to be done. Our author catalogue on cards  $5 \times 12\frac{1}{2}$  cm is different from ordinary author catalogues only in giving entries under more names and more entries under each name. We give not only all the books written, but those edited, translated, commented on, etc., thus showing under each author the total of his literary work which the library contains, except magazine articles included in our printed co-operative indexes. This catalogue includes the names of governments, societies, and other bodies responsible for their publications, and therefore treated as authors. Under titles are given periodicals, books published anonymously, and such marked titles as are apt to be known only or chiefly by titles. References are very freely used, from the various forms of a name to the form adopted.

We have conducted a series of experiments in improving the catalogue drawers and technical appliances with excellent results, having made improvements in the blocks, guards, and locking attachments, which have been adopted as the best form yet known. The most practical feature of our new catalogues is, however, the number, legibility, and utility of the guides inserted. We have combined the thinness of zinc with the legibility of print in antique or catalogue type, and by cutting away parts of the projecting guides have made it possible to find a given card in half the time, thus reducing by half the one serious difficulty in the now almost universally used card catalogues.

The small-card catalogue is really an index to the entire library, to be used in answer to the question, Have you a certain book?

In the subject catalogue we have a greater field. Here the

standard large cards,  $7\frac{1}{2} \times 12\frac{1}{2}$  cm, are used so to give room for notes underneath the full title and imprint. The cards are arranged under nearly 20,000 subject-headings, which are numbered with simple Arabic numerals and minutely indexed in a printed book, so that at a glance one may turn to any topic wished. Labels on the outside of each drawer show what subject begins each column of cards. Inside, printed guides are inserted very freely, so that the eye reads the classification from the tops of the cards without referring to the printed books which lie on the cases. By the use of type of different faces and sizes, by indentations, and by the number of figures in the class number, the place of each topic in the scheme is indicated in four ways, thus reducing the chance of confusion to a minimum. By tipping back any of these guides the sub-divisions of that head will be seen indented under it on the face of the guide below. These novel features add greatly to the practical convenience of the catalogues. In the more minute heads we again get guides with five times the frequency practicable except for the index-cutting plan we have just adopted. As a result, as fast as topics are freely "guided" or equipped with these thin index zincs with their plainly printed labels, one can open to exactly the topic wanted and save the time and annoyance of turning a long row of cards one at a time in looking for a place which in many catalogues is not easily recognized even when found.

The subject cards bear not only the number of the book but often many cross-reference numbers showing on what other topics the book also treats. All these reference numbers are printed in red ink by our new numbering machines. At the top of the card a red number shows that the book has valuable matter on that subject in addition to its treatment of the subject indicated by the blue number below the red, which shows also where the book is placed. On many of the minute topics in our catalogue there is not a book in the library, sometimes not in existence, but these red reference cards may send a reader directly to a score of books and to the exact pages where will be found valuable discussions of the topic.

To these guards and guides we are at last ready to begin adding our bibliographical notes. In this work the co-operation of our professors enables us to make our catalogue more useful than would be possible without the aid of many specialists. Light-blue cards of the same size will be used for these bibliographical notes. These cards will be headed with the number and name of the subject and in a blank form.

"The best popular treatise on this subject is\_\_\_\_\_

\_\_\_\_\_."

"The best scholarly or exhaustive treatise is\_\_\_\_\_

\_\_\_\_\_."

Specialists will fill in sufficient titles of one or more of the best books, or rather give the cataloguer the information so it can be neatly copied on the machine or in the very legible library hand. To these titles will be added such brief notes, in the most compact form possible, as will be most helpful to a reader studying that subject. These blue cards go next after the guide at the beginning of the subject, and are to be used not only for the main classes, but for divisions, sections, and sub-sections—*e. g.*, one card may be for 300 Sociology in general. Another for 330 Political Economy. Another for 331 Capital and Labor. Another for 331.8 the Laboring Classes, and finally another for 331.89 Strikes. A student is liable to seek guidance at any point in this series, and the blue-card system is as well adapted to the specific topic, Strikes, as to the general subject, Sociology. Finally, after the last sub-section has been reached, we still need the help of the specialist in giving us material for wise and helpful notes on the individual books, and for these notes the large card leaves space. In a card catalogue this can be added as found or needed, and whenever a note is found that is incorrect or superseded, it is but trifling labor to take out the card and replace it with the later information.



Such a system of notes is of necessity a somewhat slow growth, but it holds available at a moment's notice to any of our staff or readers the essence of the advice about books and reading of not only our professors and specialists, but of many others, for so many libraries are now using our Decimal Classification, that we find it practicable to co-operate in printing in legible type the best of the notes made at each library, and by exchanging these identical cards, of the identical standard size, we shall each get in print a more carefully prepared note at much less cost than we could have written it.

The result of several years' work on this plan can readily be foreseen. The cards will contain the best advice the librarians and professors can give. They are never "out to lunch," or "just gone home," or "too busy" to answer questions. They never forget, nor are impatient of correction or repeated consultation. The most skilful librarian in time dies or resigns, and his accumulated wisdom and good advice to readers go with him, leaving his successor to begin, not where he left off, but where he began before, a generation earlier. But with our new catalogue, each librarian stands on the shoulders of his predecessors. Every reader is told that he shares the responsibility of finding errors or notes that should be brought down to date, and thus, by the generous co-operation of all interested, the catalogue grows each day more and more valuable. Old librarians and workers in libraries who have examined our plan uniformly predict for it the foremost place on the score of practical utility to readers. Now that we have our cards written as a basis for this work, we feel confident that as it grows our trustees will be abundantly satisfied with the expenditure which it has involved.

As a foundation for all this, our scheme of classification and the alphabetical index have, with labor beyond the comprehension of any one who has not attempted it, been enlarged from forty pages to over three hundred, and printed. Cases have been built, and the cards put in for use. Electric connections have been made, so that a stu-

dent's lamp is available for every drawer. Trays with blank call-slips and copies of the Classification and Indexes lie within reach of each reader's hand. A page, and when needed, two, are stationed near the catalogues to receive the slip with the number of the book wanted, and bring it as quickly as possible to the reader's table, the number of which he may give on his call-slip instead of his name.

**Shelf Department.**—In this important department we have introduced several new features, which promise the best results. The most important is the very minute classification by subjects, so that standing side by side, as far as practicable, all material on each topic may be seen together. The advantage of this in a university library, where students are so freely admitted to the shelves, can hardly be overrated. The old plan of sub-dividing books by sizes, using adjustable shelves and grouping together by themselves the 8vo., 12mo, 16mo, 24mo, 32mo, etc., sizes, has been abandoned in favor of the vastly more useful subject-grouping, which gives shelves less regular in appearance, but more useful to readers. We set the library shelves uniformly 25 cm apart, and place in its exact place by subjects every book and pamphlet which will go on a shelf of that height (*i.e.*, every book from the largest marked 8° by the A. L. A. rule, to the smallest). For the quartos and small folios, we turn three of these standard shelves into two, and place there all books not over 35 cm in height. For the folios from 35 to 50 cm we turn two 25 cm shelves into one of 50 cm where there is depth enough, or use the deep shelves below the ledge. Few books over 50 cm should stand on their edges, and all these very large folios are shelved on their sides.

By means of an ingenious clip, devised for our library, plainly printed labels are attached to the edge of the shelves, showing where each subject begins. These give both the number and the name of the topic, and save probably half the time in finding what is wanted. The effect is to turn our shelves largely into a subject-catalogue. Books removed from the shelves because of their size, great cost, or rarity,

for temporary reference use, and books lost are represented by their wood dummies, which are plainly lettered, with the name, class, and number of the book, and below in print an explanation why the book is not in its proper place, and where it may be found.

In numbering the backs of books, we have abandoned the old paper numbers, which disfigure the book so seriously and continually peel off and which are so often illegible, and are having our permanent class and book numbers handsomely gilded on every volume. We had to try over a dozen binders before we found one who would do the work to our satisfaction. But we have now bought the necessary outfit, and are having this work admirably done at a cost of three cents per volume. On law sheep, calf, and other light colors, where gilt is not as distinct, we have them stamped in ink, and thus avoid putting on a darker-colored label, which after many years is liable to peel off. As by our peculiar system our numbers are entirely permanent, this gilding will prove a real economy in the end, and its appearance has caused much commendation from visiting librarians.

We have also avoided the inconvenience of having to consult a separate pamphlet and serial collection, by devising a cheap but more satisfactory pamphlet-case, which, without wasting room on the shelves, enables us to keep side by side with the books on each minute topic all the pamphlets, clippings, and mss. which we may have bearing on that topic. These cases are plainly numbered with our machines and lettered with the subject of their contents or with the name of the periodical, of which the case contains the current numbers. Newspaper clippings are mounted on flat sheets of manila paper of standard size, 20 x 25 cm, and bearing the class number in the corner. These are then treated as if thin pamphlets on the topic. Although we divide into nearly twenty thousand subjects, we waste little space by this system of cases, as the thinnest case is no more than a stout manila envelope, which occupies only two thicknesses of paper more than its contents. Where we have more material we use a thin wood case  $2\frac{1}{2}$  cm in thick-

ness, while for the regular subjects on which pamphlets are more numerous, we use the full 6 cm case. As fast as enough pamphlets on one subject, or one phase of the subject accumulate in these cases, they are bound regularly, but under no circumstances do we bind together two pamphlets that are not on the same topic. We are therefore enabled to keep up a more minute classification than has ever before been attempted, to the very great practical convenience of librarians and readers.

Under each subject on the shelves there is a sub-arrangement determined by the book number gilded on the backs. Thus every book is not only assigned to the most minute and specific topic that will contain it, but it has an exact place on the shelf under that topic, and in all records, calling for, charging, renewing and returning books, etc., this number, as gilded on the back, is a complete identification, making it unnecessary to add the name of author or the title, and therefore greatly expediting all the work. The arrangement in most subjects is alphabetical by the authors' names, the book number being the first initial of the name, followed by a number which is a translation of the balance of the name into figures. While at first glance it would seem unwise for alphabetical arrangement to change letters into figures; experience has proved that a great saving is thereby effected, and that the books can be handled much more rapidly by the attendants, *e. g.*, a book by Burns is B 93, by Burr B 94, by Burt B 95. A table guides the cataloguer in assigning these numbers, but the readers need know nothing of them. If arranged in numerical order he will find them as well in alphabetical order. The credit for this useful table belongs to Mr. C. A. Cutter, of the Boston Athenæum.

In the two classes, Science and Useful Arts, we have introduced a new plan by which the books stand in chronological order; the oldest book in the library being on the extreme left, the latest on the right. The reader thus has mapped out the historical development of the subject, and is reminded constantly of the author's place by his position on

the shelves. As he takes down a book he knows the author may have read any of those standing on the left, but could not have seen any of those standing on the right. When he goes to any subject, wishing to see the latest works on it, he may take those at the right without stopping to look at their dates. In science the question of time is so much more important than in literature and the other topics that we have tried this experiment where it seemed most likely to be of value. Here again it is found economy to translate the dates into a number.

The table used is as follows :

A.	B.C.		
B.	A.D.— 999	I.	1820—1829
C.	1000—1499	J.	1830—1839
D.	1500—1599	K.	1840—1849
E.	1600—1699	L.	1850—1859
F.	1700—1799	M.	1860—1869
G.	1800—1809	N.	1870—1879
H.	1810—1819	O.	1880—1889

Thus all books first published in the last decade have a number beginning with N, and the figure following shows the exact year, 1874 is N 4, 1875, N 9, 1869 M 9, etc. Where more than one book on the same specific subject appears in the same year another character is added to prevent confusion, as each number is limited strictly to its own book. A practical solution has been found for the difficulties connected with this scheme and we are pleased with its workings. It was devised in our own catalogue department by Mr. W. S. Biscoe, the librarian in charge.

Finally, the student at our shelves finds the cross-references, which in other libraries are limited to the catalogue, if indeed they are given there, marked plainly on the book-plate also, with an indication of the exact page where the matter referred to begins and ends, and where a case seems to warrant it, a large light-blue card inserted in the pamphlet case at the end of the subject, gives other notes and aids to readers examining that topic. As these references and

notes accumulate from year to year our shelves will become more and more helpful to readers. It may seem a useless labor to specify the pages for a reference, but often one is sent to a book as containing matter on a certain topic and finds no index, or a very imperfect one, and is compelled to waste his time in finding his matter, which he should be able to use in reading it. Or having found the reference in the index, he opens there and finds a paragraph on the topic followed by another which seems to be on quite another subject, and closes the book confident that he has seen all that was referred to, while in fact the author may, after a few sentences of digression, have returned to the main subject and discussed it in a score of pages. We find that it is the work of a few seconds when the classifier and analyzer has the book before him, and knows just where each topic begins and ends, to jot the fact on the book-plate, and as long as the book-plate lasts every reader consulting this book for this topic will be helped by having the information plainly written inside the cover. We make it our rule throughout the library to incur any trifling labor or expense if it is clear that our readers will save more than it costs us.

Our catalogue is now so far advanced that we are able to take the regular account of stock, the results of which will hereafter appear as part of our statistics. A satisfactory examination has not been practicable up to this time because so many of the books were in process of cataloguing and circulation at the same time. We have just been over the 11,938 volumes of history and find 39 missing from their proper places on the shelves. Of these, each week, some are recovered or returned. The indication is that the number by misplacement and loss will be gratifyingly smaller than we expected when we threw 40,000 volumes open to the free handling of all our readers—numbering at times over 10,000 per month. If a small number of these should never be found we shall feel that their cost is not too high a price to pay for the great privilege accorded.

**Reference Department.**—This work is growing constantly in extent and usefulness, as pointed out on p. 17 of the

Library Circular. We esteem this perhaps the most important single department, and two librarians give their time to aiding readers, who are learning more and more, first, to go to them for assistance, and then how to profit by such help so much that they will no longer need it. Although we are hardly yet started, because of the arrears to the removal of which we at first assigned the first three years, yet we see abundant evidence of the deeper hold the library is taking on an increasing number of officers and students, who are learning how important a factor it is coming to be. With our catalogues now made available, our classification printed, shelves labelled, and in all respects a fuller opportunity to do our work, we expect that the progress each year will be substantial.

**Loan Department.**—We have from the first discouraged the taking of books from the library as much as possible, wishing to keep our resources more nearly complete during all the hours of daily opening. Notwithstanding this the home use of the library constantly increases. The liberal gift by the present graduating class will enable us to more fully meet the demands of those who wish, what we certainly ought to supply, the highest grade of recreative reading. The old rule of the library has been the exclusion of every thing of the kind, and the theory was carried to such an extreme that while we had able professors lecturing on our famous authors, we had of many of them not a page in our library. Our present plan is to include the works of all authors studied in the courses in literature, *i. e.*, we try to have the best editions of all authors that may be fairly counted as classic. I am promised the co-operation of the professors in preparing and posting lists of the books recommended for such reading. By these lists, and by putting the best books on special shelves bearing the printed card which shows the recommendations of the professors, we hope largely to control and elevate this supplementary reading, of which it is likely and desirable that each student will do not a little during his four years' course.

To accommodate those who have special reason for wish-

ing a reference book temporarily in some other room, we use a pink slip with a blank agreement to return it at a specified hour, and allow a book from which a lecturer wishes to read an extract or specially needed elsewhere to be temporarily removed from its place on the reference shelves. This modification of the rule that reference books shall not leave the library has been a practical convenience, often saving laborious copying of a dozen pages by a half hour's loan of the book itself.

We allow all readers to renew their books by postal card without the labor of bringing them to the library, till some other reader requiring them makes it necessary that they be returned. This plan saves both the time of the reader and useless wear of the books in carrying them back and forth. We also allow any reader to put a reserve on any book he wishes to receive as soon as it is returned, or if his need is urgent, we recall it from the person having it out. Though not required to do so, we uniformly send notices to all officers of the quarterly renewal required by the trustees, and try to aid and make the rules easy for the patrons of the loan department in every practicable way.

By our system of double charges we can tell instantly the whereabouts of any book off the shelves, or exactly what books any given reader has out. A certain number of errors have been inevitable during our reorganization and cataloguing, but as the work nears completion all this work can be done more rapidly and accurately.

**Binding.**—The plan of binding reported has continued to give entire satisfaction. The materials used, especially the morocco, have been the best, bought or imported from our own specifications. We have found it real economy to abandon the use of sheep or roan entirely. If the book is properly sewed and forwarded the extra cost for the back of Turkey morocco instead of sheep is only eight or ten cents, and the extra durability, even of books little used, and therefore suffering more from the action of heat and time than from direct wear, more than justifies the trifling added cost. Books not worth this we now bind in cloth,



having secured a contract at very low prices. We tried for some time the experiment of binding pamphlets and little-used books in half skiver with flush boards ; but the books soon wore to ragged edges, were from the first cheap and ugly in appearance, and we are now convinced that at our present prices the handsomer cloth binding is also the cheaper. Our list of about five hundred serials involves a large annual expense for binding. The cost of repairs and of books worn out and rebound is surprisingly low. We have completed a large number of imperfect sets and volumes, and collected and bound altogether many valuable sets of reports and pamphlets on special topics. This has swelled our binding bills, but on the other hand has placed in the library a mass of material not to be had in any other way, and vastly more valuable than the considerable sum it has cost us. It is well known that odd pamphlets to be had for the asking, and commercially valueless in miscellaneous bundles, if closely classified and bound by topics so that in one cover is bound fifteen or twenty pamphlets, on some specific subject, attain a high commercial value to any one specially interested in that subject.

During the year I have made some careful studies, with a view of reducing the cost of binding to the lowest sum consistent with true economy. The results are published in the *Library Journal*, p. 161.

**School of Library Economy.**—Under the head of Staff, I have noted the preliminary work that has been going successfully forward. In the appended *Library Circular* is given in full the plans which we have worked out for the School. It only remains to add to these full discussions to which reference is made, that longer observation of the needs of libraries and those wishing to enter on librarianship as a life-work, and the opinions of those who are giving to the subject most attention, fully confirm the decision that we should open such a School, and the applications already made for entrance indicate that we shall have of desirable pupils, more than we hoped or have thus far provided for.

There are various other matters to which I should gladly call attention, but the length of my report constrains me to defer them.

I beg again to refer you to the Library Circular for 1886, which contains much which might be properly included in this report, and for detailed facts to the papers annexed.

In reviewing the past two years, I find abundant cause for congratulation on the rapid and healthful growth and on the acknowledged position already attained by our new library. Yet we are still looking to the near future as of even greater promise.

Respectfully submitted,

MELVIL DEWEY,  
*Chief Librarian.*

Columbia College, July, 1886.

**PAPERS SUPPLEMENTARY TO THE LIBRARIAN'S REPORT.**

*I.—RESOLUTIONS.*

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Below is given a selection from the resolutions passed by the Library Committee, which are self-explanatory, and are recorded here for convenient reference.

**Annual report.**—In order that the committee, trustees, and others interested may have the necessary data for studying the growth, use, administration, and needs of the library, *ordered* that the chief librarian submit to the committee at the first regular meeting of each fiscal year a report for the past year, with statistics of growth, size, use, and such other facts as may be necessary to give a correct idea of the work of the past year.

**Smoking.**—*Resolved*, That the chief librarian be directed strictly to enforce the rule of no smoking in the rooms or corridors of the library building.

**Topics.**—*Resolved*, That officers of instruction be requested to report as early as practicable to the library, subjects to be studied, themes to be assigned, etc., in their respective departments, in order that more thorough provision may be made for aiding students, by collecting and cataloguing material. Also that such officers be requested to furnish the library with lists of books they may wish transferred to the reading-room reference shelves, or withdrawn from circulation during the study of the topic.

**Alumni appeal.**—*Resolved*, That the chief librarian be directed to prepare a circular-letter to alumni and friends of the college, stating what is doing and the claims of the library, and asking gifts of books and pamphlets.

**Stained-glass windows.**—*Resolved*, That we approve of the chief librarian's plan for a series of stained-glass windows, as given in the *Acta Columbiana*, page 60, and that we

authorize the acceptance of any such windows offered by the classes or individuals, provided that the design and workmanship is satisfactory to the chief librarian and the architect of the college.

**Wall inscriptions.**—Also that we approve of suitable inscriptions for the walls, under the same conditions.

**Over 20 volumes to officers.**—*Resolved*, That the Administration Sub-Committee be recommended to give no permanent permits to officers of the college to borrow to exceed 20 volumes at a time, and to grant special permits of this kind only in special emergencies, and for limited periods.

**Loans to libraries.**—*Resolved*, That the chief librarian be authorized, in special cases, to lend to other libraries, temporarily, books which they cannot obtain readily, and which can be spared without inconveniencing our own readers.

**Lending outside Columbia College.**—*Resolved*, That the committee decline all requests to borrow books, from persons not officers, graduates, or students of Columbia College, except in cases where, for special reasons, it may seem proper to invest another with the rights of an alumnus, as is done for donors to the amount of \$100.

**Class photographs.**—*Resolved*, That the graduating class be asked to deposit in the library as complete a collection as possible of their class photographs, bound up with statistics, etc.

**Deposit of theses, etc., by students.**—*Ordered* (by the trustees) that all students who speak on the Commencement stage, or who may receive college degrees, certificates, or prizes for any theses, essay, oration, or other written matter, shall be required to deposit a copy of the same in the college library, either printed, or plainly written on paper of uniform size, for binding, and to be furnished by the library, and before receiving such degrees, certificate, or prize, each student shall show a receipt from the chief librarian showing that the required deposit has been made.

**Alumni Publications.**—*Resolved*, That an effort be made to secure a copy of each publication, book, or pamphlet made by a graduate, or officer of Columbia College, that there be made a catalogue of all such, and that a request be

sent to each author asking the gift, for this collection, of any of his writings that the college may lack.

**Harper's Magazine articles.**—*Resolved*, That this committee ask of Messrs. Harper & Brothers permission to reprint the valuable articles on King's and Columbia Colleges published in their magazine for October and November, 1884. [This request has been promptly and courteously granted, and it is hoped that copies may soon be available for distribution.]

**Text-books.**—*Resolved*, That duplicates of some of the most needed text-books be provided in the reading-room, for the accommodation of students who may wish to study between hours without bringing their books from home.

**Votes of thanks.**—The trustees have passed the following votes of special thanks to friends of the library :

*Resolved*, That the thanks of this Board be presented to Messrs. Lloyd and Phillips Phoenix for the gift to the library of an admirably executed portrait of their lamented brother, Stephen Whitney Phoenix, deceased, whose splendid bequest has added so much to the value of our library.

*Resolved*, That the thanks of this Board be presented to Mr. J. F. Loubat for his munificent gift of valuable books to the library of the college, and that a copy of this resolution be communicated to Mr. Loubat by the clerk of the Board.

*Resolved*, That this Board recognize with pleasure the spirit of affection for their alma mater displayed by the graduating class of 1885, in the presentation to the college of a beautiful stained-glass window, having an interesting classical subject for its design, and intended to adorn the large reading-hall of the library.

*Resolved*, That the thanks of the trustees be presented to the class for this valuable addition to the attractions of the library, and that a copy of these resolutions be communicated to the class by the clerk of the Board.

*Resolved*, That the Library Committee express its thanks to Mayor Seth Low for his interest and efforts in behalf of the library, which have resulted in the offer to have deposited here the very valuable historical collection known as the Townsend Civil-War Records.

The cordial vote of thanks to Hon. A. A. Low for his gift of \$5,000 for urgently needed books originated with the trustees, and so is not on the library records.

The trustees have also passed the following :

**College publications.**—*Whereas*, The Library Committee are by statute already entrusted with all college publications, and

*Whereas*, Greater efficiency can be secured by having all the publications issued under an organized system, in charge of a single committee, therefore

*Resolved*, That, unless otherwise ordered by the Board, the Committee on the Library shall have charge of the printing of all matter published by the authority of the Board of Trustees, with power to fix the size and style, and to distribute the number of copies directed by the Board of Trustees, and to make any regulations needed to secure efficiency or economy.

Frequent difficulties have arisen because of imperfect sets of minor college publications. The convenience of the officers of the college requires that the statutes, resolutions, and other publications shall be readily accessible, in their latest authorized form, and the library should preserve, as a matter of history, a complete record of all changes and additions in such publications. The library, being the only department accessible during the entire day and evening, and also during the entire year, is therefore the most convenient place. In view of these considerations, the trustees have *ordered* that not less than three copies of all reports of committees, or other matter printed by authority of the Board, shall be deposited in the library, and that the chief librarian shall keep one copy of all college publications corrected up to date, with all changes or additions to statutes, resolutions, or other publications of the Board.

**Deposit of libraries.**—*Whereas*, Overtures have been made, and are likely to be made, from time to time, from associations, for the advancement or diffusion of knowledge, for the permanent deposit of the libraries belonging to such associations in the library building of Columbia College, to be subject to the use, in consideration of the safe keeping

of the same, of the officers, students, and alumni of the college,

*Resolved*, That all such propositions be referred to the Committee on the Library to consider and report.

Hereunto appended will be found tables showing additions to the library by gift or purchase, the use of the books by readers or borrowers, the state of the catalogues, and the appropriations and expenditures for the year 1885-6.

All which is respectfully submitted.

MELVIL DEWEY,

*Chief Librarian of Columbia College.*

Columbia College, June 30, 1886.

## II.—DONATIONS TO THE LIBRARY.

MAY 7, 1883 TO JUNE 30, 1886.

	Vols.	Pan.	Other		Vols.	Pan.	Other
Abbott, Austin . . . . .		6		Angel, Prest. . . . .	1		
Abbott, B. V. & A. . . . .	8			Annals of Mathematics . . . . .		1	
Aberdeen Free Pub. Li- brary, Scotland . . . . .	1			Anthony, E. & H. T. . . . .	7		
Addeman, J. M. . . . .		3		Anthropological Soc. . . . .	1		
Adelbert Coll. . . . .		2		Archæological Inst. of Am. . . . .	3	2	
Aiken, Dr. Edw. . . . .	1			Archer, W. . . . .	3		
Alabama . . . . .	1			Argentine Republic . . . . .		18	
Albany Y. M. Ass'n . . . . .		2		Armstrong, R. F. . . . .		2	
Alexander, Prof. A. . . . .	37			L'Art Pub. Co. . . . .	1		
Allen, J. M. . . . .	5			Astor Library . . . . .	3		
" Prof. W. F. . . . .	1	1		Austen, Prof. Peter T. . . . .		2	
Alpha Delta Phi . . . . .	1			Baker, G. H. . . . .	82	7	
Altgeld, Jno. P. . . . .		1		" W. G. . . . .	32		
Am. Academy of Arts and Sciences . . . . .	1			" Voorhis & Co. . . . .	8		
Am. Antiquarian Society . . . . .	19			Baldwin's Monthly . . . . .	1		
Am. Ass'n Advancement of Science . . . . .	1			Baltimore Com. Public Schools . . . . .		1	
Am. Banker's Ass'n . . . . .	1			Bancroft, F. A. . . . .	1		
" Bar Ass'n . . . . .	2			" Jane M. . . . .		1	
" Chemical Soc. . . . .	1			Bangs & Co. . . . .	2		
" District Telegraph Co. . . . .	1			Banks & Bros. . . . .	1		
" Inst. Mining Engineers . . . . .	2			Barnard, Pres. F. A. P. . . . .	778 (8,772)	22	
" Library Ass'n . . . . .	37	600		Barnes, Dr. Carl . . . . .		2	
" Lithographic Co. . . . .		1		Barrell, H. F. . . . .	2		
" Philosophical Soc. . . . .	1			Beck, F. C. T. . . . .	1		
" Soc. Mechanical En- gineers . . . . .	2			Beckh, Leopold von . . . . .	1	6	
Amherst College . . . . .		3		Bell, Clark . . . . .		1	
Andover Theol. Sem. . . . .		2		Bergakademie K. Sächs Berlin Kön. tech. hoch- schule . . . . .	5		

	Vols.	Pam.	Other		Vols.	Pam.	Other
Bernheim, A. L. . . . .	1			Church, J. A. . . . .	57	22	
Birmingham Free Libraries		1		Cincinnati Board of Educa-			
Biscoe, W. S. . . . .	10			tion . . . . .	1		
Blair, H. W. . . . .	4			Cincinnati Pub. Lib. . . . .	3		
Bliss, R. . . . .	1			" Coll. Law School			1
Bolton, Prof. H. C. . . . .	1	1		City and Guilds of London			
Bookstaver, H. W. . . . .	1			Institute . . . . .			1
Boston Public Library . . . . .	1	2		Civil-Service Ref. Ass'n . . . . .			2
" Record Comm. . . . .	14			Claremont, (N. H.) . . . . .	1		
" University . . . . .		1		Clark, S. C. . . . .			3
Bostonian Society . . . . .		1		Cleveland Pub. Library . . . . .	2		
Bowdoin College . . . . .		1		Clouston, W. A. . . . .	2		1
Bowker, R. R. . . . .	1			Coan, T. M. . . . .	8		1
Boyesen, Prof. H. H. . . . .	5			Cobden Club . . . . .	7		
Bradlee, C. D. . . . .		4		Cochrane, J. . . . .	1		
Bradley, Hon. C. S. . . . .	1	1		Coe, Miss Ellen M. . . . .			1
Bradstreet's, Pub. of . . . . .	1			Coffin, S. J. . . . .	1		
Braschi, V. M. . . . .	1			Cohen, Oscar Joseph . . . . .	29		
Britton, N. L. . . . .	6	11		Cole, G. W. . . . .			1
Brookline Library . . . . .		1		College of New Jersey . . . . .	1		
Brooklyn Board of Educa-				Physicians and			
tion . . . . .	1			Surgeons, Boston . . . . .	3		
Brooklyn Daily Eagle . . . . .		2		Colorado State School of			
" Library . . . . .		2		Mines . . . . .			4
Brown, G. . . . .	2			Columbia College . . . . .	1		
" Guy A. . . . .		1		" Alumni . . . . .	1		
" J. S. . . . .	2	5		" Architect. Dept. . . . .	1		
" M. E. . . . .	1			" Botany Dept. . . . .	26		
" W. T. . . . .		1		" Class of '86 . . . . .	228		
Brownell, T. F. . . . .	1			" Columbiad . . . . .	2		
Brunnow, Rudolph . . . . .		1		" Greek Dept. . . . .	68		
Bryn Mawr College . . . . .		1		" Jurist Editors . . . . .	2		
Buffalo Historical Soc. . . . .		5		" Miner Law Sch'l . . . . .	2		
" Library . . . . .	1			" Math. Dept. . . . .	5		
Burr, F. M. . . . .	1			" School of Mines . . . . .	1		
Butler, N. M. . . . .	7			" Faculty . . . . .	5		
California Bureau Labor				" College, School of			
Statistics . . . . .	1			Mines Quarterly . . . . .	51		
California Mining Bureau . . . . .	1			Coni, E. R. . . . .	1		
Cambridge Civil - Service				Connecticut . . . . .	8		
Ref. Ass'n . . . . .	1			" Insurance Com-			
Canada Geol. and Nat.				missioners . . . . .	2		
Hist. Survey . . . . .	5	5		Conn. Bureau of Labor			
Carleton Coll. . . . .		1		Statistics . . . . .	1		
Carswell & Co. . . . .		1		Consolidated Electric Light			
Carter, H. L. . . . .	5			Co. . . . .			1
Chamberlain, Hon. M. . . . .	1			Constant, S. Victor . . . . .	1		
Chamberlin, T. L. . . . .	28			Cook, G. H. . . . .	2		
Chambers, T. W. . . . .	18	1		Cooper, P. . . . .	1		
Chandler, Prof. C. F. . . . .	6	1		" Union, Trustees . . . . .			1
Chase, Prof. Geo. . . . .	3			Co-operative Congress . . . . .	6		
Chazal, Philip E. . . . .	4			Cope, Prof. E. D. . . . .			7
Chicago Pub. Library . . . . .		1		Cornell, R. L. . . . .			4
Chili . . . . .	3			Cornell University . . . . .			1
Christian, C. A. . . . .	5	43		Costigan, T. . . . .	2		



	Vols.	Pam.	Other		Vols.	Pam.	Other
Cox, Hon. W. R. . . . .		1		General Theol. Sem., N.Y.			1
Cragin, F. W. . . . .		3		Gibson, A. M. . . . .	1		
Croes, J. J. R. . . . .		1		Gilman, A. . . . .	1		
Cutler, Prest. Carroll . . . .		1		Ginn & Co. . . . .	1		
Cutter, C. A. . . . .	3			Goepel & Raegener . . . .	1		
Daily Register Publishers . .	4			Goodnow, F. J. . . . .	1		
Dartmouth College . . . . .		1		Gove, G. . . . .	1		
Davies, Julien T. . . . .	253			Grant, S. Hastings . . . .			1
Decker, J. H. . . . .		1		Gray, Albert L. . . . .			1
DeLeon, D. . . . .		1		" S. M. . . . .	1		
Dennis, H. J. . . . .		2		Greenwood, I. J. . . . .			1
De Peyster, Gen. J. Watts . .	6	21		Griswold, S. B. . . . .	1		
Dewey, Melvil . . . . .	23	1,417		Grolier Club . . . . .	1		
Diocese of Iowa . . . . .		1		Guthrie, Malcolm . . . .	1		
Dixon, Mrs. J. E. . . . .		1		Guzman, D. . . . .	1		
Dodge, D. K. . . . .		1		Hall, E. W. . . . .			52
" W. E. . . . .	1			Hallam, John . . . . .			1
Domett, H. W. . . . .	2			Halsey, G. H. . . . .	22		
Donnell, E. J. . . . .		1		Hamilton College . . . .			1
Dows, H. A. . . . .		3		Hamlin, Rev. Cyrus . . .	1		
Draper, Daniel . . . . .		1		Harris, G. W. . . . .			1
Drisler, Prof. H. . . . .	18	291		Harris Inst. Lib. . . . .	1		
Duffield, Rev. S. W. . . . .	1			Harrison, G. D. L. . . .	9		3
Dunning, W. A. . . . .	2			" W. H., Family of . .			192
Dwight, H. E. . . . .	2			Hartford Ins. Co. . . . .	2		
" T. W. . . . .	4	3		Harvard Col. . . . .	3		3
Edgerton, Winifred . . . . .	1			" Medical School . . .			1
Edison Electric Light Co. . .	2	1		" Observatory . . . .	1		
Edmands, John . . . . .		1		" Theol. Faculty . . .	1		
Egleston, Prof. T. . . . .	10	53		Hascall, J. F. . . . .	1		
Engineer's Club of Phila. . .	2			Hauck, Guido . . . . .			2
England Incorporated Coun- cil of Law . . . . .	2			Hazen, W. B. . . . .	1		
Field, David Dudley . . . . .		1		Hewitt, A. S. . . . .	12		
Fifield, B. F. . . . .	2			Hill, F. P. . . . .	1		
Financier Co. . . . .	1			Hodges, N. D. C. . . . .			50
Fisk, Henry E. . . . .	3	2		Hoffman, C. F. . . . .	1		
Fletcher, J. F. . . . .	2			Holls, F. W. . . . .	5		
Fletcher Free Library . . . .		1		Homes, H. A. . . . .	2		
Flower, R. P. . . . .	3			Hoole, W. E. . . . .			2
" R. W. . . . .	1			Hopkins, E. W. . . . .	1		
Forbes, Rev. J. F. . . . .	1			Horsford, Prof. E. N. . .			2
Forrest, Jas. . . . .	1			Howard University . . . .			1
Foster, W. E. . . . .	1			Hudson, J. R. . . . .	2		
France . . . . .	4			Huguenot Soc. of Am. . .			1
Francis, Jos. . . . .	1			Hutchins, E. R. . . . .	1		
Francis, S. W. . . . .	3	2		Ill. Bureau of Labor Sta- tistics . . . . .			3
Franklin Inst., Phila. . . . .		2		Ill. R. R. and Warehouse Commiss. . . . .			4
Frazer, P. . . . .	1			Ill. Industrial Univ. . . .	1		
Frost, H. H. . . . .	3			Indiana . . . . .	1		
Fuller, Rev. S. . . . .		2		Inst. of Civil Engineers, London . . . . .	13		1
Gambier Coll. . . . .		1		Inter. Invention Exhibit. .			1
Gardiner, J. T. . . . .	1			Iowa . . . . .	14		
Garman, S. . . . .		2					
Garnett, M. Jas. . . . .		1					

	Vols.	Pam.	Other		Vols.	Pam.	Other
Iowa R.R. Commissioners.		1		Marks, Montague . . . .			1
" State Librarian . . .	25			Martin, C. D. . . . .	1		
" State University . . .		1		" E. W. . . . .		1	
Irving, R. D. . . . .	2			Maryland Ins. Dept. . .	1		
Jarvis, G. A. . . . .	1			Mass. State Agri. Ex. Sta-			16
Johns Hopkins University		1		tion . . . . .			
Johnson, Franklin . . . .	1			Mass. Board of Health . .	1		
" Henry . . . . .		1		" Bureau of Statistics			
Joy, Prof. C. A., Munich .	11	281	86	of Labor . . . . .	11		
Kansas Insurance Supt. . .	12			Mass. Civil Service Com. .		1	
" R.R. Commiss. . . . .	3			" Insurance Com. . . .	5	1	
Kato, H. . . . .		1		" R. R. " . . . .	12		
Kellogg, E. L., & Co. . . .		1		" Sec. of State . . . .		1	
Kelly, Edw. . . . .		1		" Inst. of Technology,		2	
Kempton & Thacher . . . .			1	" State Library . . . .	148		
Kentucky Ins. Commiss. . .	15			" Topograph'l Survey.		4	
Kenyon College, O. . . . .		1		Master Car Builders' Ass'n		2	
Kimball, J. P. . . . .	1			Mead, D. S. . . . .	9		
Kitchen, J. M. W. . . . .	4			Mechanics and Tradesmen			
Knapp, S. A. . . . .		1		Soc., N. Y. . . . .		1	
Kneeland, S. . . . .		1		Medical Association . . .	2		
Knortz, Karl . . . . .	5	55		Medico-legal Soc. . . .	1		
Kost, H. G. . . . .		1		Melbourne Dept. of Mines	1		
Kunz, G. F. . . . .		2		Merriam, Prof. A. C. . .	11	7	
Lacombe, B. H. . . . .		2		Metropolitan Museum of			
Lane, G. W. . . . .	1			Art . . . . .		1	
Lawrence, W. . . . .		2		Mexican Legation at Wash-			
Lawrence Pub. Lib. . . . .		1		ington . . . . .	1		
Lea, Isaac . . . . .		1		Mexico . . . . .	27		
Leeds, Prof. A. R. . . . .	1	1		Meylert, A. P. . . . .	1		
Leeds, Eng., Public Library		1		Michels, J. . . . .	1		
Levey, A. A. . . . .	1			Michigan Insurance Com. .	3		
Lewis, Rev. A. H. . . . .	5	42		" Bureau of Labor,	1		
" H. C. . . . .		1		" Legislature . . . .	1		
Library Journal . . . . .	2			" R. R. Com. . . . .	1		
Lindsey, D. P. . . . .		1		" Sec. of State . . . .		63	
Linnæan Soc. . . . .	2			" State Library . . . .	1		
Lippincott, J. B., & Co. . .	1			" University . . . . .		3	
Lord, J. S. . . . .	1			Middlebury College . . .		1	
Loubat, J. F. . . . .	2			Middlesex Mechanics As-			
Lovell . . . . .	1			sociation, Lowell, Mass.		1	
Lowell, Mass. . . . .		1		Minnesota . . . . .		1	
Lowell City Library . . . .		1		Missouri . . . . .	4		
Ludlow, T. W. . . . .		2		" Bureau of Labor			
" W. . . . .	3			Statistics . . . . .	1		
Luskey, H. . . . .	1			Missouri R. R. Com. . . .	1		
MacCall, J. A. . . . .	13			Mitchell, T. C. . . . .	1		
McCamant, Joel B. . . . .	3			" Library, Glasgow		1	
McDonnell Bros. . . . .		1		Moldenke, C. E. . . . .		1	
Mackintosh, J. B. . . . .		1		" R. G. G. . . . .	1		
McMullen, J. . . . .		1		Monte L. del . . . . .	62		
MacQueen . . . . .	1			Moore, W. S. . . . .	3		
Maimonides Library . . . .		1		Morgan, E. G. . . . .	1		
Maine . . . . .	1			Morse Inst. . . . .		1	
Manchester Co-op've Board .	3			Munich, Akad. d. Wissen.,	1		

	Vols.	Pam.	Other		Vols.	Pam.	Other
Munsell, C. E. . . . .	1			North Carolina . . . . .	2		
Nat. Academy of Science .	1			No. Transcontinental Surv.	3		
Nat. Ass'n of Wool Mfrs.	1			No. West. University, Ill.		1	
" Bi-Metallic Coinage				Nova Scotia, Supt. Educa-			
Ass'n . . . . .	5			tion . . . . .		1	
Nat. Civil-Service Reform				Oberlin College . . . . .		1	
League . . . . .	1			Ohio . . . . .	5		
Nat. Grange . . . . .	5			" Insurance Dept.	4		
Nebraska . . . . .	2			" State Forestry Ass'n .		1	
Nestel, Knight . . . . .		1		" " University . . . .		1	
New Hampshire . . . . .	3			" Wesleyan " . . . . .			
New Jersey . . . . .	5			Ontario, Minister of Edu-			
" Board of Educa-				cation . . . . .		1	
tion . . . . .	1			Oregon . . . . .	1		
New Jersey Bureau of Sta-				Ouro Preto . . . . .		2	
tistics of Labor and In-				Panama Canal . . . . .		1	
dustries . . . . .	7			Peabody Inst., Baltimore .	1		
New Jersey State Geolo-				" Museum . . . . .	2		
gist . . . . .		4		Peck, C. F. . . . .		2	
New Jersey State Library	1			Peele, W. A. . . . .	5		
New South Wales . . . .	2			Peithologian Soc. . . . .	640		
N. Y. City . . . . .	26			Pellew, C. E. . . . .	1		
" " Bd. of Educa.	1			Pennsylvania . . . . .	1		
" " Bd. Police Jus.	3			" Ins. Com. . . . .	4		
" " Dept. of Public				" Hist. Soc. . . . .	1		
Works . . . . .	1			" Univ. . . . .		2	
N. Y. State . . . . .	38			Petty, J. R. . . . .	1		
" " Assembly . . . .	12			Phila. Acad. of Nat. Science	1		
" " Bureau of La-				" Mercantile Library .		2	
bor Statistics . . . . .	3			Phil. Providence Life and			
N. Y. State Ins. Depart .	1			Trust Co. . . . .	1		
" " Library . . . . .	4			Philolexian Soc. . . . .	529		
" " R. R. Com . . . .	4			Phoenix Estate . . . . .	1	12	
" " Survey . . . . .	1			Photogravure Co. . . . .	1		
" " Univ. . . . .	10	1		Pickering, Prof. E. C. . .		5	
" and Brooklyn Bridge	1			Pillsbury, Parker . . . .		2	
Academy of Science . .	2			Pine, J. B. . . . .	1		
Agri. Soc. . . . .	2			Pond, C. V. R. . . . .	2	1	
" Cham. of Commerce	8			Porto Academia, Portugal .		1	
" Free Circ. Library .	1			Pott, Jas. . . . .		2	
" Hist. Soc. . . . .		1		Potter, O. B. . . . .	1		
" Mercantile Library .		1		Potts, Wm. . . . .		3	
" Produce Exchange .	14			Price, Prof. T. R. . . . .	1		
" Prot. Epis. City Mis-				Protap, Chandra Roy. . . .	1		
sion Soc. . . . .		1		Prot. Epis. Church . . . .	1		
N. Y. Shakspeare Soc. . .	2			Providence . . . . .	1	3	
" Soc. for the Preven-				" Public Library.		1	
tion of Cruelty to Chil-				Prussia, Geol. Landesanstalt	2	3	1
dren . . . . .	5			Putnam, L. E. . . . .			1
N. Y. Y. M. C. A. . . . .		1		Putnam's, G. P., Sons . .			
Newlands, J. A. K. . . .	1			Q. P. Index, Bangor, Me. .		3	
Nicholson, E. B., Oxford .	1			Quandt & Händel . . . .	1		
Nimmo, J. . . . .	1			Quaritch, Bernard . . . .		1	
Nolf, Andres L. . . . .		1		Quicken, C. F. . . . .	1		
Nordin, A. T. . . . .	3			Racine College . . . . .		1	

	Vols.	Pam.	Other		Vols.	Pam.	Other
Randol, Jas. B. . . . .	4	6		Smith, J. Alden . . . . .		1	
Ranney, G. E. . . . .	1	1		"    J. S. . . . .		4	
Ransom, W. C. . . . .	5	1		"    Prof. R. M. . . . .	5		
Rawl, E. F. . . . .	6			Smithsonian Institution . . . . .	6	5	
Redwood Library and Athe- næum . . . . .		1		Soc. de legislation comparée . . . . .	1		
Reed, Mrs. C. G. . . . .		1		Société Franklin, Paris . . . . .	2	48	
Reyes, E. . . . .		1		Soc. for Political Educ. . . . .		2	
Rhoads, Prest. Jas. E. . . . .		1		Soc. of Telegraphic Engi- neers . . . . .	1		
Rhode Island, Sec'y of State . . . . .		1		Soule & Bugbee . . . . .	1		
Rice, F. P. . . . .		1		South Carolina . . . . .	4		
Richards, Edgar . . . . .		1		S. W. Presb. University . . . . .		1	
Richardson, Rev. E. C. . . . .	1			Speman, W. . . . .		4	
Richmond Col. . . . .		1		Sprague, C. E. . . . .		3	
"    Free Public Lib. . . . .		1		Springfield Library, Mass. . . . .	3		
Ricord, T. W. . . . .	1			Squires, Grant . . . . .	4		
Rives, G. L. . . . .	8			Stanton, H. B. . . . .		1	
Robinson, S. . . . .	1			State Charities Aid Ass'n . . . . .		8	
Rochester, Univ. of . . . . .		7		Staten Island Academy . . . . .		1	
Rodman, Edmund . . . . .		1		Statistical Soc. Lib. . . . .	1		
Roebing's Sons . . . . .	1			Stearns, G. T. . . . .		3	
Roelker . . . . .	4			Stechert, G. E. . . . .	12		
Romero, Matias . . . . .	2			Steiger, E. . . . .		1	
Rood, Prof. O. N. . . . .	21	108		Stratton, G. W. . . . .		1	
Rowell, J. C. . . . .		6		Straus, O. S. . . . .	2		
Royal Astronomical Soc. . . . .	4	4		Sumner, Mrs. M. B. . . . .		1	
"    Dublin Soc. . . . .	2			Swan, Chas. H. . . . .		1	
"    Inst. Brit. Arch. . . . .	1			Swank, J. M. . . . .	1		
"    Soc. of Canada . . . . .	1			Swarthmore College . . . . .		1	
"    London . . . . .	2			Syracuse Univ. . . . .		1	
Rutger's Col. . . . .		2		Taunton Public Lib. . . . .		2	
Ryan, R. L., & Co. . . . .	1			Tedder, H. R., London . . . . .		1	
Ryland, Chas. H. . . . .	1			Tenn. Board of Health . . . . .	1		
St. John's Col. . . . .		1		Terhune, R. H. . . . .		1	
St. Louis Mercantile Li- brary Ass'n . . . . .		2		Texas, University of . . . . .		1	
St. Louis Public Library . . . . .		1		Thompson, A. R. . . . .	1		
St. Nicholas Soc. of N. Y. . . . .	1			"    H. M. . . . .	1		
San Francisco Mercantile Lib. . . . .		2		Todd, John A. . . . .	1		
San Francisco, P. L. . . . .	1			Tokio University, Japan . . . . .	1		
Satterlee, H. L. . . . .	1			Toledo Public Library . . . . .	1		
Sawyer Free Library . . . . .	1			Toronto " " . . . . .	1		
Schultze, E. A. . . . .	7			Torrey, Miss E. . . . .	2		
Seligman, E. R. A. . . . .	68			"    Botanical Club . . . . .	23		
Sellers, Colman . . . . .	1	4		Towne, H. R. . . . .	1		
Sewell & Co. . . . .	1			"    P. A. . . . .	1		
Sewell, W. J. . . . .	1			Townsend, J. J. . . . .	2	1	
Shepard, E. F. . . . .	1			Trinity College . . . . .		2	
Short, Prof. Chas. . . . .	6			Trowbridge, Prof. W. P. . . . .	1		
Silliman, Prof. B. . . . .		1		Tuft's College . . . . .		2	
Simonson, G. . . . .	2			Union Defence Committee . . . . .	1	1	
Smith, C. P. . . . .	1			"    Theol. Seminary . . . . .		2	
"    Prof. C. S. . . . .	1			U. S. . . . .	278	9	
"    E. A. . . . .		2		"    Dept. of Agriculture . . . . .		1	
				"    Civil-Service Com. . . . .		2	
				"    Bureau of Education . . . . .	3	13	

	Vols.	Pam.	Other		Vols.	Pam.	Other
U. S. Chief Eng. U. S. A.	1	4		Washburn College . . .			4
" Geological Survey . . .	2			" Observatory . . .	3		
" Dept. of the Interior . . .	103	4		Washington University . . .			1
" " Justice . . .		7		Watertown Pub. Library . . .			1
" Library of Congress . . .		2		Webster, Frank B. . . . .			1
" Light-house Board . . .	1			Weeks, S. R. . . . .			2
" Military Academy . . .		1		Wells Memorial Ass'n . . .			2
" Naval Inst. . . . .		7		West Virginia . . . . .	1		7
" " Observatory . . .	3			Wey, Wm. C. . . . .			1
" Bureau of Navigation . . .	1			White, Prest. A. D. . . . .			1
" Navy Dept. . . . .		2		Whitney, D. J. . . . .			6
" Patent Office . . . . .	1			Whittingham, Miss . . . .			3
" State Dept. . . . .	1	26		Wicksteed, R. J. . . . .			1
" Treasury Dept. . . . .	8	1		Wilds, H. P. . . . .			9
" War . . . . .	20	4		Willcox, H. . . . .			10
" " Dept. Sig. Office . . .	1			Williams College . . . . .			1
University College, Tor-				Winchell, W. H. . . . .	1		
onto, Canada . . . . .		1		Winsor, Justin . . . . .			2
Van Amringe, Prof. J. H. . .		3		Winthrop, Hon. R. C. . . .			3
Venezuela . . . . .	95	89		Wire, Geo. E., M. D. . . .			1
Veirty, Mrs. L. J. . . . .	2			Wisconsin . . . . .	2		
Vermont . . . . .	1			" R. R. Com. . . . .	3		
" Gen. Assembly . . . . .	4			" State Hist. Soc. . . . .	3	2	
" Univ. . . . .		2		Woman's Ed. Club . . . . .	1		
Virginia R. R. Com. . . . .	4			" Med. College of . . . . .			
" University . . . . .	1			Pennsylvania . . . . .			1
Wales, N. S. . . . .	1			Worcester Pub. Library . . .	1		
Waller, Prof. E. . . . .		1		Wright, H. . . . .			2
Walter, W. M. . . . .		1		Yale College . . . . .			3
Ward, Anna L. . . . .	6			" " Library . . . . .	2		
Ware, Prof. W. R. . . . .	11	5		Unknown Donors . . . . .	60	123	

Besides these, there have been received large numbers of pamphlets by mail which were not recorded, as there was no clue to their source. These will hereafter be entered like books under "Unknown."



## V.—Serials Received July 1, 1886.

Subject Number.	Subject.	Given.	Bought.	Total.	Cost.	Daily.	Weekly.	Monthly.	Quarterly.	Yearly.	Irregular.
010	BIBLIOGRAPHY . . . . .	7	17	24	\$46.00		1	12	1	2	8
030	GENERAL CYCLOPEDIAS . . . . .		3	3	21.50					1	2
050	" PERIODICALS . . . . .	3	27	30	148.50		12	13	4	1	
105	PHILOSOPHY . . . . .	—	10	10	35.00		1	3	5	1	
205	RELIGION . . . . .	—	3	3	12.30			1	2		
310	STATISTICS . . . . .	—	7	7	10.16			1	1	5	
320	POLITICAL SCIENCE . . . . .	3	11	14	96.11		1	5	3	2	3
330	" ECONOMY . . . . .	4	4	8	20.00		2	1		5	
340	LAW . . . . .	4	18	22	81.00	1	4	8	2	4	3
370	EDUCATION . . . . .	6	8	14	17.00		2	3	4	2	3
400	PHILOLOGY . . . . .	—	32	32	124.70		1	6	11	2	12
500	NATURAL SCIENCES . . . . .	16	35	51	98.43		5	14	4	8	20
510	Mathematics . . . . .	1	10	11	52.12			4	7		
520	Astronomy . . . . .	3	8	11	25.00			6	2	3	
530	Physics . . . . .	3	6	9	33.00					1	7
540	Chemistry . . . . .	3	22	25	103.75		2	9	1	6	5
550	Geology . . . . .	27	14	41	63.12		1	9	10	16	3
560	Paleontology . . . . .	—	3	3	23.34					1	13
580	Botany . . . . .	19	12	31	43.48		2	14	1		
590	Zoology . . . . .	1	1	1	7.50			1			
600	USEFUL ARTS . . . . .	17	14	31	71.45		14	8	2	3	4
620	Engineering . . . . .	22	30	52	100.99		18	19	3	5	7
660	Chemical Technology . . . . .	1	8	9	40.00		6	1		2	
700	FINE ARTS . . . . .	5	9	14	44.75		7	4	1	1	1
800	LITERATURE . . . . .		7	7	20.00						7
900	HISTORY . . . . .	17	25	42	135.08			9	7	3	23
		161	344	505	\$1,474.28	1	87	151	71	74	121

Daily publications	.	.	.	.	.	.	.	1
Weekly	"	.	.	.	.	.	.	87
Monthly	"	.	.	.	.	.	.	151
Quarterly	"	.	.	.	.	.	.	71
Yearly	"	.	.	.	.	.	.	74
Irregular	"	.	.	.	.	.	.	121

505

The list above does not include a large number of serials received and preserved, but not bound and catalogued because of comparatively little value. The large number of gifts arises not from binding such matter, freely sent to any large library, but because we have the valuable scientific exchanges of the School of Mines Quarterly, the Torrey Botanical Club, and other journals and societies connected with the college or meeting here, who find it more useful to give us their files than to own them themselves, as we make them so much more accessible at all hours.

The column of cost includes only the subscription paid. The binding is charged separately.

#### VI.—Monthly Use, 1885–6.

	Days Open.	Readers.	New Loans.	Renewals.	Total Loans.	Daily Average.	Fines Received.	Readers' Tickets Issued.
July . . . . .	27	865	269	51	320	11.8	\$1.05	12
August . . . . .	26	744	217	83	300	11.5	3.05	3
September . . . . .	26	1,289	194	78	272	10.4	5.80	7
October . . . . .	27	10,496	663	276	939	34.7	11.00	29
November . . . . .	25	11,618	745	108	853	34.1	9.80	18
December . . . . .	27	8,063	642	321	963	35.6	9.95	23
January . . . . .	26	9,534	695	195	890	34.2	16.25	52
February . . . . .	24	8,993	726	151	877	36.5	12.70	29
March . . . . .	27	10,521	792	210	1,002	37.1	21.25	13
April . . . . .	25	10,192	737	448	1,185	47.4	8.90	33
May . . . . .	26	8,921	548	203	751	28.8	18.45	15
June . . . . .	26	4,242	468	317	785	30.2	20.35	12
<b>Total . . . . .</b>	<b>312</b>	<b>85,478</b>	<b>6,696</b>	<b>2,441</b>	<b>9,137</b>	<b>29.3</b>	<b>\$138.55</b>	<b>246</b>



*Cards Put in Catalogues.*

1886	Author.	Sub- ject.	Title.	Total.
Jan. .	4,943	3,333	402	8,678
Feb. .	3,410	3,334	274	7,018
March	5,567	2,773	518	8,858
April .	3,001	2,421	345	5,767
May .	3,308	1,813	713	5,834
June .	4,364	4,734	508	9,606
<b>Total</b>	<b>24,593</b>	<b>18,408</b>	<b>2,760</b>	<b>45,761</b>

Of the 73,775 volumes in the library,  
 21,601 are not yet shelf listed.  
 13,127 " " " " classified and re-  
 vided.  
 10,881 are not yet classified.  
 7,114 " " " " accessioned.  
 7,000 " " " " carded.  
 These we hope to complete during  
 the next year.

*VII.—Volumes on Shelves and Cards in Subject-Catalogue for  
 the Ten Main Classes and Hundred Main Divisions.*

These tables show how many volumes are now on the shelves in each main class and division, and how many cards have thus far been written and put in the subject-catalogue. They are of course incomplete till the cataloguing of the library is finished, but will serve for comparison from year to year, and show just what additions are made to books and catalogue in each subject. Our own ms. record is here as elsewhere much fuller, and can be consulted by those interested. We record the number of volumes in each of the fifteen to twenty thousand subject-heads into which we classify the library, our system giving such a record with little extra labor.

Subject-Cards in Drawers.	Volumes on Shelves.	Classes.
760	3,537	GENERAL WORKS.
854	994	PHILOSOPHY.
336	3,498	RELIGION.
4,731	17,386	SOCIOLOGY.
1,414	1,772	PHILOLOGY.
6,370	10,381	NATURAL SCIENCE.
1,082	5,695	USEFUL ARTS.
82	1,115	FINE ARTS.
4,787	9,764	LITERATURE.
9,041	11,938	HISTORY.
<b>29,457</b>	<b>66,080</b>	

Subject-Cards.	Vols. on Shelves.	Division.		Subject-Cards.	Vols. on Shelves.	Division.	
			o General Works.				
600	1153	010	BIBLIOGRAPHY.	277	1897	500	Natural Science.
103	150	020	LIBRARY ECONOMY.	1176	1027	510	MATHEMATICS.
3	276	030	GENERAL CYCLOPEDIAS.	1012	1108	520	ASTRONOMY.
0	10	040	" COLLECTIONS.	958	944	530	PHYSICS.
7	1872	050	" PERIODICALS.	809	2044	540	CHEMISTRY.
6	1	060	" SOCIETIES.	692	1089	550	GEOLOGY.
1	22	070	NEWSPAPERS.	91	133	560	PALEONTOLOGY.
0	0	080	SPECIAL LIBRARIES, POLY-	191	240	570	BIOLOGY.
		090	GRAPHY.	902	1316	580	BOTANY.
40	47		BOOK RARITIES.	262	487	590	ZOOLOGY.
760	3537			6370	10,381		
63	111	100	Philosophy.	107	1578	600	Useful Arts.
50	33	110	METAPHYSICS.	55	757	610	MEDICINE.
26	29	120	SPECIAL METAPHYSICAL TOPICS.	560	1775	620	ENGINEERING.
102	87	130	MIND AND BODY.	54	349	630	AGRICULTURE.
10	10	140	PHILOSOPHICAL SYSTEMS.	15	22	640	DOMESTIC ECONOMY.
65	69	150	MENTAL FACULTIES, PSYCHOLOGY.	19	125	650	COMMUNICATION AND COMMERCE.
62	63	160	LOGIC.	238	905	660	CHEMICAL TECHNOLOGY.
251	226	170	ETHICS.	6	77	670	MANUFACTURES.
68	98	180	ANCIENT PHILOSOPHERS.	12	37	680	MECHANIC TRADES.
157	278	190	MODERN PHILOSOPHERS.	16	79	690	BUILDING.
854	994			1082	5695		
7	359	200	Religion.	11	367	700	Fine Arts.
20	117	210	NATURAL THEOLOGY.	7	41	710	LANDSCAPE GARDENING.
68	614	220	BIBLE.	7	243	720	ARCHITECTURE.
28	420	230	DOCTRINAL THEOLOGY, DOGMATICS.	12	108	730	SCULPTURE.
87	261	240	PRACTICAL AND DEVOTIONAL.	13	44	740	DRAWING, DESIGN, DECORATION.
25	288	250	HOMILITICAL, PASTORAL, PAROCHIAL.	10	70	750	PAINTING.
20	219	260	CHURCH, INSTITUTIONS, WORK.	3	29	760	ENGRAVING.
26	330	270	RELIGIOUS HISTORY.	7	72	770	PHOTOGRAPHY.
17	729	280	CHRISTIAN CHURCHES AND SECTS.	12	55	780	MUSIC.
38	161	290	NON-CHRISTIAN RELIGIONS.	20	86	790	AMUSEMENTS.
336	3498			102	1115		
115	250	300	Sociology.	142	181	800	Literature.
195	341	310	STATISTICS.	640	709	810	AMERICAN.
653	4165	320	POLITICAL SCIENCE.	698	2806	820	ENGLISH.
931	1324	330	" ECONOMY.	441	736	830	GERMAN.
1287	9386	340	LAW.	32	838	840	FRENCH.
340	549	350	ADMINISTRATION.	44	475	850	ITALIAN.
125	243	360	ASSOCIATIONS AND INSTITUTIONS.	4	155	860	SPANISH.
647	724	370	EDUCATION.	1069	1450	870	LATIN.
337	282	380	COMMERCE AND COMMUNICATION.	1697	2203	880	GREEK.
101	122	390	CUSTOMS, COSTUMES, FOLK-LORE.	20	211	890	MINOR LANGUAGES.
4731	17,386			4787	9764		
73	307	400	Philology.	191	546	900	History.
102	117	410	COMPARATIVE.	2929	3924	910	GEOGRAPHY AND DESCRIPTION.
280	197	420	ENGLISH.	3002	2740	920	BIOGRAPHY.
95	121	430	GERMAN.	322	600	930	ANCIENT HISTORY.
87	99	440	FRENCH.	1564	2659	940	EUROPE.
25	40	450	ITALIAN.	93	110	950	ASIA.
20	21	460	SPANISH.	28	22	960	AFRICA.
225	246	470	LATIN.	867	1244	970	NORTH AMERICA.
325	378	480	GREEK.	33	68	980	SOUTH AMERICA.
182	246	490	MINOR LANGUAGES.	12	21	990	OCEANIC AND POLAR REGIONS.
1414	1772			9041	11,934		

Total volumes . . . 66,076

Total cards . . . 29,477

## VIII.—EXPENDITURES.

1ST JULY, 1885, TO 30TH JUNE, 1886.

## BOOK APPROPRIATION.

Books (including law reports, etc.).....	\$7,508 94
Serials.....	1,501 85
Binding and gilding Nos. on books.....	2,796 97
<b>Total</b> .....	<b>\$11,807 76</b>

## INCIDENTAL APPROPRIATION.

## FITTINGS.

Library fittings.....	\$568 17
Desk “.....	13 66
Miscel. “.....	7 15
<b>Total</b> .....	<b>\$588 98</b>

## SUPPLIES.

Library supplies.....	\$173 45
Stationery.....	159 70
Miscel. supplies.....	94 41
<b>Total</b> .....	<b>\$427 56</b>

## INCIDENTALS.

Printing.....	\$1,073 09
Postage and telegrams.....	114 18
Express and freight.....	125 64
Cleaning.....	129 25
Laundry.....	32 84
Car fares.....	23 46
Repairs.....	47 40
Miscellaneous incidentals.....	63 53
<b>Total</b> .....	<b>\$1,609 39</b>

## SALARY APPROPRIATION.

Administration : executive, accession, reference, and loan departments.....	\$12,691 86
Cataloguing, classification, analysis, and shelf-list departments.....	3,522 14
<b>Total salaries.....</b>	<b>\$16,214 00</b>
<b>Total of bills paid in 1885-86.....</b>	<b>\$30,647 69</b>

*Note.*—These totals do not exactly agree with the funds drawn from the treasurer, as these represent the cash actually paid out each month by the cashier at the library, and the vouchers as paid by the treasurer often include bills which have come over June 30th, when the fiscal year ends. The corrected totals for the past year are :

**Books, \$11,807.76.**

**Incidentals, \$2,625.93.**

**Salaries, \$16,214.00.**

**Total expenditures for library, \$30,647.69.** This does not include any bills for building, furniture, repairs, heating, lighting, insurance, or janitors, which are paid from other funds.

**APPENDIX C.**  
**SUMMER CLASSES.**

PRACTICAL WORK IN THE VACATION.

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*To the President of Columbia College :*

I transmit herewith the reports of Prof. H. S. Munroe on the work of the Classes in Practical Mining and in Surveying carried on during the long vacation of the summer of 1885 ; and the report of Adj. Professor F. R. Hutton on that of the Class in Mechanical Engineering conducted by him during the same period.

These reports will show that the advantages offered by these classes are appreciated by the students attending them, no less fully than they have been in former years : and the results to which they have led have been equally satisfactory.

Respectfully submitted,

W. P. TROWBRIDGE,  
*Professor of Engineering.*

Columbia College, May 1, 1886.

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*REPORT ON THE SUMMER SCHOOL IN PRACTICAL MINING.*

*Prof. Wm. P. Trowbridge :*

DEAR SIR.—I have the honor to make the following report on the work of the ninth session of the Summer School of Practical Mining which was held during the past summer in the iron regions of Northern New Jersey, and in the

anthracite and semi-bituminous regions of Northeastern Pennsylvania.

Last year, as in previous summers, three volunteer assistants were appointed under the authority conferred by the trustees, viz.:

Edward Renshaw Bush, E. M., '81,  
James Furman Kemp, E. M., '84,  
Robert Van Arsdale Norris, E. M., '85.

We were exceedingly fortunate this year in securing assistants well fitted for the work, and men of character and energy, whose influence upon the students was most admirable.

The following students attended the Summer School of Practical Mining as required by statute. One student, of the second class, was given special permission by the faculty to attend this summer instead of next, and three students of the third class were denied permission to attend under the rule excluding conditioned students from the privileges of the summer schools.

Henderson M. Bell,	Staunton, Va.
Henry D. Conant,	Orange, N. J.
William B. Chamberlain,	Spring Lake, N. J.
Richard M. Edwards,	Houghton, Mich.
George M. H. Good,	Osceola Mills, Pa.
Epenetus Howe,	North Salem, N. Y.
John H. Janeway, Jr.,	Governor's Island, N. Y.
Arthur W. Jenks,	Grand Rapids, Mich.
Alexander Laist,	Cincinnati, Ohio.
Edgar L. Newhouse,	Philadelphia, Pa.
Lucien H. Norton,	Bridgeport, Conn.
James J. Ormsbee,	Brooklyn, N. Y.
Theodore Osterheld,	Yonkers, N. Y.
Staunton B. Peck,	New York City.
Henry H. Porter, Jr.,	New York City.
Augustus M. Ryan,	Brooklyn, N. Y.
Joseph G. Seligman,	New York City.
Robert H. Stodder,	Chicago, Ill.
Ernest R. Von Nardroff,	Brooklyn, N. Y.
Wm. R. Wharton,	New River, Va.

The class, it will be seen, was smaller than for some years past, numbering twenty men only. It is interesting to note that an increasing proportion of the students come from a distance to attend the School of Mines, indicating, perhaps, that the advantages offered by the school are becoming more widely known.

It was proposed this year to give the school a more extended scope than usual, and to include work and study in both anthracite and semi-bituminous coal mines, as well as in iron and zinc mines in New Jersey. A preliminary trip was therefore made over the route selected, and arrangements made at several points for the reception of the students. On this trip the professor met with most cordial endorsement of his plans from the officers of the various mining companies, both in New Jersey and in Pennsylvania. It was finally decided to begin work at Hibernia, N. J., in the mines worked by the Glendon Iron Co. and by the Andover Iron Co., and to spend there and in that vicinity about three weeks in detailed study of iron mining. For the study of anthracite-coal mining Pittston, in the Wyoming valley, was selected for the head-quarters of the class, and in like manner the mines of the Fall Brook Coal Co., at Antrim, in the Blossbury coal region, for the study of bituminous-coal mining practice. Arrangements were also made for excursions and visits to a number of mines, blast-furnaces, steel-works, and other points of interest in connection with the other work. As in past years, however, these excursions and visits were made subordinate to the more thorough and detailed study of mining methods and mine plant at a few typical mines, where the students visited the same working places day after day, studying one subject at a time, with abundant opportunity to take full notes and to make detailed sketches.

For the three weeks devoted to the study of iron mining, board and lodging was secured for the students at a hotel in Rockaway, about four miles from Hibernia. Transportation to and from the mines was furnished free of cost by the Hibernia Mine R. R. Co. on one of the regular trains

in the morning, and in the evening on a special train run for our benefit.

As there was reason to suspect that the water at the hotel might be contaminated by sewage, a sample was sent to the School of Mines for analysis. The precaution proved to be well taken, as the sample first sent was condemned by Dr. Waller, and of a number of samples subsequently submitted to him from the same vicinity but one proved altogether satisfactory. This water, which was used during our stay, both for drinking and for cooking, was procured from a spring about a mile from town. Samples of water from Pittston, Pa., and from Litchfield, Conn., the head-quarters selected for the Summer School of Surveying, were also submitted to Dr. Waller. Whether the precautions taken to secure good water had any effect or not, it gives me pleasure to report that the health of the students in both summer schools was unusually good this year.

The class assembled at Rockaway on Saturday, June 20th, and began work at the Hibernia mines on Monday, June 22d. These mines are admirably worked and afford unusual advantages for the study of practical mining. The blasting in the sinking of shafts, in the driving of levels, and in the stoping of the ore is all done with machine-drills, and with high explosives. The mine-timbering is very complete, and examples are to be found of nearly all the different forms usual in metal mines. On account of the extent of the mines, and the necessity for continual repair of the timbering in the old workings, a large force of timbermen is kept constantly at work, and the students had the opportunity of seeing all the details of the timberman's work, as well as to examine and sketch many interesting examples of finished timbering. The handling of the iron ore after it is broken down in the stopes is unusually well organized, and the new screening arrangements and loading "docks" furnished many interesting details for study. In the Andover mine large double-acting plunger pumps have been recently added to the mine plant.

The following outline of work was prepared for the use



of the students and served as a guide to them in the direction of their practical studies. A special subject was assigned to each student for study and observation each day. The work as laid down in the scheme occupied the men from June 22d to July 8th, inclusive, the time being nearly equally divided between the subjects of blasting, in shafts, drifts, and stopes, of timbering, of pumps, and of handling and transportation of ore and rock.

## SCHEME OF STUDY.

### I. DRILLING AND BLASTING.

1. *Sinking, Drifting, and Stopping by Hand and Machine*: Observe details of setting machines, including preliminary work required, the position, direction, and depth of holes bored, and reasons for such location and depth. Speed of boring; delays, and their cause. Weight of machines and methods of handling in stopes, etc.; disposal of machines during blast. Arrangement of blast-holes and general system of blasting followed in drifting, sinking, and stopping. The number of men employed in each case and the duties of each man. Number of drills, hammers, shovels, and other tools required.

2. *Sketches and Drawings*: Sketches of tools used. Make sketches showing the methods of setting the machines with the use of supporting columns or tripods, etc. Make detail drawings to scale of the parts of a drill as found in the machine shops, and explain the use of each part. Note any special modifications or improvements made in the mine shops in drills, columns, tripods, or in their separate parts. Make drawings to scale in three projections, showing the position of several separate holes in a drift, in a shaft, and in a stope, numbering the blast-holes in the order of firing. Holes bored in absence of student put in in dotted lines.

3. *Blasting*: Observe methods of charging blast-holes with powder and with dynamite; kind and trade name of powder or other explosives used; number and size of cartridges or weight of powder in each hole; kind of tamping used, whence obtained, tools used and method of tamping, precautions against accident. Firing of blasts, kind and quality of fuse, and caps or other exploders, electric firing, method of lighting fuse. Compare different blasts by measuring depth of holes and line of least resistance in each case and determining the relation of charge to cube of line of least resistance by the following formula—dynamite fired by a cap being considered five times as strong as black powder fired by a fuse.

$$1. \frac{L^3}{P}$$

$$2. \frac{L^3}{5 D}$$

$$3. \frac{L^3}{3 P \times 5 D}$$

L. Line of least resistance in feet.

P. Lbs. of powder.

D. Lbs. of dynamite.

NOTE.—Use formula 1 for powder, formula 2 for dynamite, and formula 3 when both are used in one hole.

Observe effect of blast and note signs of excessive charges of powder, viz. : projection of ore, crushing of rock about the blast-hole, excessive breaking of ore, and large proportion of fines. Note also any damage to timber, etc., by the blast. Note circumstances requiring heavy charge, "tight corners," etc. Note effect of blast, whether satisfactory to miners, and reasons for failure of any blast or abandonment of any hole.

4. Inquire the number of feet driven or sunk during one month, and number of tons stoped with one drill or by one party of men, also average progress. Number of drills dulled. Supplies and steel used. Details and contracts. Inquire the reasons for the preference in kinds of drills and supports, and reasons for kind of explosive used.

## 2. TIMBERING.

1. Observe methods of putting in timber, measuring, cutting timber and lowering into mine, handling under ground, cutting hitches in rock, hoisting timber into place, especially methods of securing tackle, and securing timber in place. Methods of staging to reach high timbering requiring renewal. Methods of removing old and rotten timber, causes of deterioration.

2. Sketch and describe different forms of timbering used in mine : "stulls," "studdles," "lagging," "wall plates," "lacing," "blocking," "legs," "caps," "sills," "crib work," "batteries," "guttering," etc., and "back stulls," "travelling way," "rock stulls," etc. Sketch timbering of stopes, shafts, and tunnels, including methods of supporting tracks, skip-roads, slides, pump-rods, and ladders, and details of landing stage and sollars. Drawings to scale of the timbering of the shaft between two levels, including batteries, pillar facing, etc. Sketches of the timbering in the gunnies or stopes between two shafts and between the top of one ore pillar and the top of the one below, in both longitudinal and cross section, and give estimate of amount of timber, and for comparison an estimate of the amount of ore taken out. Sketch arrangements for protecting men and machinery from blasts and falling rocks, batteries, pentice, etc., and arrangements for preventing the fall of the pump-rods in case of breakage. Also sketches of chutes, landings, etc., required in handling ore and rock.

3. Inquire what kinds of timber are used, whence obtained, seasoned *vs.* green timber, stripping of bark, and life of timber.

## 3. HANDLING OF ORE.

Observe method of bringing ore to foot of stope, block-holing, sledging, and other methods of breaking large pieces, sorting of ore from rock, loading of cars or barrows, skips, buckets, etc., and dumping and transfer of ore at different points; capacity of buckets, cars, etc. Describe underground locomotive, weight, dimensions, gauge of track, size of cylinders, stroke, and diameter and number of drivers.

Describe hoisting-engines, dimensions, speed, steam pressure, valve motion, gearing, etc. Construction of drum, diameter and length of same, means of

throwing in and out of gear, details of brakes, number of revolutions per minute, and time required to hoist from bottom. Size and character of wire rope and chain, and method of attaching same to skips or buckets. Tell-tale and signals, position of each and use; speed of buckets, skips, and cars.

Handling of ore on surface, loading of cars, screening, breaking, and separation of rock; loading and transportation to market.

Handling and disposal of waste rock, underground and on surface.

Inquire the number of tons of ore hoisted, and quantity of timber lowered per month.

Sketches; detail sketches of tram-cars, skips, buckets, stope-cars; loading platform and chutes underground; and of sheaves, guide-rollers, tracks, turn-outs, switches, and dumping devices on surface and in mine.

Detail sketches to scales of derricks, whims, poppet-head, etc. Drawings to scale showing construction in detail of new screens and ore docks.

#### 4. PUMPS.

1. Observe the location and general arrangement of pumping-engines, bobs, pump-rods, plunger, and lift-pumps, sumps, forks, cisterns, and column pipes. Location of special steam and compressed air-pumps underground, and of lines of steam and air pipe; support and covering of pipes and disposal of exhaust steam. Stroke of pumps and of pumping-engines, diameter, speed, etc. Repairs and packing. Calculate number of gallons of water pumped per day. Sumps and methods of disposing of water during sinking of pumping shafts. General system of drainage of mine and reasons for location of pumps. Relative amount of water in different levels and in different parts of mine.

2. Sketch and describe details of pumping-engines, arrangement of engine and gearing and connection with rods. Make a drawing on a small scale of the entire pumping system of a mine, and drawings to a larger scale of the details of the lift, jack-head, plunger and double plunger pumps, and their connection with the pump-rods. Details of bobs, methods of joining, supporting, and guiding rods. Arrangements for arresting fall of rods in case of breakage.

3. Inquire kind and durability of packing used and amount of attention and labor required in caring for pumping plant and frequency of packing and repairs.

#### 5. EXPLOITATION.

Describe the general plan of working the deposit, including development by sinking and drifting, and method of starting and working the stopes. Make longitudinal and cross sections of mine showing location of shafts, levels, stopes, pillars, etc., and illustrating fully the method of working. Show location of pumps, hoisting-engines, and compressors, and lines of steam, air and water pipe, and indicate by arrows the course of the ventilating currents.

#### 6. SHOPS.

Sketches showing arrangement of blacksmith's-shop, machine-shop, carpenter-shop, etc. Description of the method of sharpening and tempering moils, picks, etc. Sharpening, tempering, and repairs of bits of machine drills.

Work of machine-shop, repairs to pumps, rock-drills, and other machinery.

Note parts of drills most liable to wear and breakage. Work of carpenter-shop, making of ladders, pump-rods, tram-cars, and miscellaneous repairs. Number of men required in each shop.

#### 7. SURFACE WORKS.

Sketch map showing relative position of surface works, shafts, slopes, tunnels; engine and boiler houses, shops, offices, dwellings and other buildings; ore docks, railroad tracks, switches, turn-outs, etc., tram-ways and roads; lines of steam, water, and air pipes; and of surface drainage. Descriptions of above buildings, roads, etc., and notes on source of water supply for boilers and for household use. General description of miners' houses, number, internal arrangements, etc. Detail plans of shops, boiler and compressor plants, and engine houses.

#### 8. COMPRESSORS.

Describe air compressors used, dimensions of steam and air cylinders; details of valve and valve motion; pressure of steam and of air; methods of cooling air; receivers, size, character and number; diameter and length of air pipes; purposes for which compressed air is used; estimate of cost of compressed air, and proportion of cost chargeable to different machines.

#### 9. FORMATION OF ORE DEPOSITS.

Observe the strike and dip of the wall rock and pitch of included ore bodies. Also the following characteristic features of a magnetite deposit: lenses or pods and their general shape and size so far as developed by mining, pinches and swells, faults (called also throws or offsets), horses, and fading out of rich ore into lean and into barren rock.

Make sketches showing horizontal section of ore body at different levels.

Note also the character of the associated rocks and minerals.

HENRY S. MUNROE,

*Adj. Prof. Practical Mining.*

MORRIS CO., N. J., June 22, 1885.

In the study of practical mine-work the students were encouraged to observe carefully and critically the work going on before them, and to take full descriptive notes and sketches, rather than to attempt themselves to gain manual skill. Not that manual dexterity is not desirable, but because the other object, teaching the student to observe and to record his observations, is considered far more important, and the time devoted to practical work is insufficient for both. This summer the plan of a daily examination and marking of the students' note-books was inaugurated. These daily marks of approval or disapproval proved a

great stimulus to the students, and increased to a very marked degree both the quality and the quantity of the work done. In past years it has been very difficult to induce the students to take proper notes of their work, and to take them at the proper time. They were very apt to defer writing up their notes until the evening or some more convenient time and place. Notes so written were of necessity incomplete and untrustworthy. The daily examination of the note-books, which were collected as soon as possible after the students had completed their day's work, made it necessary for the men to elaborate their notes on the spot, and thus accomplished a most important reform in this respect. The reading of the note-books suggested to the professor in charge and to his assistants subjects which were not perfectly clear to the students, and thus assisted them in their work of instruction. At the same time each student is brought into closer personal relations with his instructors, and the supervision and direction of his work is rendered more effective—a point of great importance in large classes. Any mistakes made by the assistants in their instruction is promptly detected in the students' notes, and can be corrected at once.

After completing the scheme of study at the Hibernia mines, a few days were devoted to visiting points of interest in the region before going to Pennsylvania. On Thursday, July 9th, we visited the Chester furnace and iron mines in and near Chester, worked by the Hacklebarney Iron Co., the Chester Highland Iron Mining Co., and by Cooper, Hewitt, & Co. At the blast-furnace we were received by Mr. W. J. Taylor, the owner and manager, who explained the working of his patent roasting kiln, and all the details of iron making, from the weighing out of the charges in the stock-house, where we saw a large collection of ores from New Jersey and elsewhere, to the casting house, where we saw the furnace tapped and the metal run into pigs.

A noteworthy incident of the trip was an impromptu address to the students by Mr. Taylor while we were waiting

for a train. Mr. Taylor is a practical iron-master of acknowledged ability, a self-made and self-educated man, not only well versed in the practice of iron making, but also well informed as to the latest theoretical investigations. Mr. Taylor devoted his talk mainly to the relations between theory and practice, and urged especially upon the students the importance of making the most of their advantages for study while in the school. Hearty endorsement of this kind by practical men of the importance and advantage of theoretical studies is not uncommon, especially among such as have arrived at eminence among their fellows through their superior energy and ability, but I have rarely heard as eloquent an endorsement as from the lips of Mr. Taylor. The talk was much appreciated by the students.

At the Hacklebarney mines we had a fine opportunity of studying the characteristic pod formation common in magnetite deposits, a number of these pods being exposed by open workings and a comprehensive bird's-eye view of which was to be obtained from the top of the hill. In Chester we visited the mines of Cooper, Hewitt, & Co., and saw many interesting examples of underground work. On Friday, July 10th, we visited the Hurd mine of the Glenden Iron Co., mentioned in a former report. Saturday, July 11th, we visited the new shaft of the Dickerson Mine, where the summer class was held in 1880, and Saturday afternoon we went to Franklin, where we spent Sunday. Monday morning we went through the celebrated zinc mine of the New Jersey Zinc and Iron Co., and in the afternoon of the same day we started for Pittston, Pennsylvania, where we remained until Tuesday, July 22d, spending two weeks in the study of anthracite mining. At Pittston the class was divided into two sections, one at the Barnum mine and one at "Shaft Number Ten," both mines worked by the Pennsylvania Coal Co. The following scheme of study was prepared for the use of the students and followed by them in their work. As at Hibernia, the students each day were assigned a place and subject of study, and their notes on the same were examined and marked in the evening.

## SCHEME OF STUDY.

## I. DRIVING OF GANGWAYS.

Observe and describe general method of blasting in driving a gangway ; modifications made necessary by cleavage and bedding planes, and by partings, beds of slate, etc.

Describe boring tools used, drills (ordinary and machine), depth of holes bored, and time of boring of each ; measure pitch of hole and line of least resistance. Describe method of clearing holes, method of charging wet and dry holes, making of cartridges, amount of powder used and relation to line of least resistance.

Method of tamping and precautions against accident.

Firing of blasts with squib and blasting barrel or with use of needle. Effect of blast, amount of coal broken down, proportion of fine coal and dirt produced.

Sketch drills, tamping bar, scraper and other tools used in blasting. Sketch drilling machines. Make sectional drawings and plan of face of gangway and of breast, showing location of blast-holes and system of blasting.

## 2. MINING OF COAL AND ROBBING OF PILLARS.

Observe and describe general arrangement of breasts or chambers, noting position and width of entrance, and length, width, and general shape of chamber, thickness of breast and gangway pillars, size and location of cross cuts, and number of chambers between a pair of air-doors. Also in different mines note the relation between depth below surface, the character of roof and of coal, and the thickness of pillars and width of breasts.

Observe and describe the location of blast-holes with reference to the nature of the coal seam, its benches, partings, etc., and the method of advancing the breast in one bench or two ; disposal of slate and bony coal, as "gobbing" and by hoisting to surface. Note the organization of the party in the chamber and relations to the company and to each other.

Observe and describe handling of cars in breast and loading of coal and methods of handling coal in breasts of steep pitch. Observe and describe the method of robbing pillars, support of roof behind mines, amount removed and method of removal.

## 3. HANDLING OF COAL AND UNDERGROUND HAULAGE.

Observe the methods of breaking the coal, sorting and disposal of slate or gob. Dimensions, capacity, and weight of car. Describe methods of haulage, noting number of cars from each chamber and in each trip, and organization of trips. Kind of track in chamber, and in gangway or airway, grade and gauge of tracks, weight and section of rail, switching devices, "passing branch," etc. Use of spraggs, and method of coupling cars. Duties of driver boy and runner. Number of mules required and cars hauled under different circumstances, and total number of mules in mine. Description of underground locomotive, weight, dimensions, gauge of track, size of cylinders and stroke, diameter and number of drivers. Number of cars and total weight hauled on different

grades. Describe underground planes, length, average slope, and detailed profile; arrangement of tracks, whether single with passing switch midway, three track or double track. Note self-setting latches, and weight and character and section of rail. Give plan of plane, noting curves, guides, rollers, etc. Sketch the drum or sheaves at the top, giving dimensions of each and design of the brake, size of wire rope, and number of cars hoisted and lowered per trip and per shift. Safety gates, safety switches, drags, growlers, etc. If an engine plane note the size and character of the engines. Sketches, showing details of construction of cars, switches, and turn-tables.

Describe hoisting engines, dimensions, speed, steam pressure, valve motion, and connection with drum whether direct or by gearing. Details of brake and reversing gear. Construction of the drum, diameter and breadth of the same, coning if any, number of revolutions per minute, and time to hoist. Note also indicators or tell-tales, speaking-tubes and other signalling apparatus, and system of signals used.

Describe construction of elevator, cage or carriage, safety-clutch, bridle-chains, bonnets, detaching hooks or other precautions against over winding.

Note the method of removing loaded cars from the cage, and the return of the empties. Note grading of tracks at top and bottom of shaft to facilitate handling of cars. Note the duties of the men at the top and bottom of shaft in handling of loaded and empty cars.

#### 4. VENTILATION.

Make a sketch-map showing the course of air through the mine, showing each split. Measure air currents and give quantity of air circulating in each split, and inquire number of men at work. Note methods of measuring air and taking water gauge. Note dimensions of uptake and downtake, of airways, gangways, and cross headings between breasts. Note also and describe "brattices," "air-boxes," "air-bridges" or "crossings," "slant batteries," single and double "air doors," "safety doors," and use of "brattice cloth."

Special methods of ventilating gangways, breasts, and advance headings.

Note method of testing for gas, and show on map where it is most abundant. Note also any "blowers" of gas.

*Fan* : Draw in detail. Give kind of fan, pressure or exhaust, diameter of fan, size and number of blades, revolutions per minute. Inquire cubic feet of air delivered. Observe also shape of casing and of chimney, bearings of fan shaft, size, journals, and methods of lubricating and of avoiding heating.

*Fan-Engine* : Note general characteristics, size and speed, methods of connecting engine with fan, steam pressure used and cut off. Inquire indicated horse power.

*Furnace* : Note size, arrangement of grate-bars, etc. Make sketches showing detail of construction. Inquire coal consumption and cubic feet of air delivered, its water gauge, and temperature. Inquire also size and depth of upcast.

*Safety devices* : Note any safety devices about engine, fan, or furnace, also any supplementary ventilating arrangements and extra doors, etc., for restoring and regulating the air current in case of the breaking down of the fan or other



accidents. Notice and describe the "gas board" if any. Note mine regulations with regard to gas, make abstract of same and give reason for each requirement.

*Safety lamps*: When used, and by whom. Kinds, advantages and disadvantages of each. Care of lamps.

#### 5. DRAINAGE.

Observe and describe the character and location of pumps and the general system of bringing water to them. Size of gutters and location in gangway or airway, slope given them for drainage.

*Pumps*: Note design of "bull," "plunger," or "direct-acting" pumps, diameter and stroke, number of strokes per minute, valve motion, etc.

Observe method of supporting and guiding rods, describe the bobs, and give dimensions and character of column pipe and method of supporting same. Calculate the weight of column pipe and water contained, and the weight borne by each stull or other support. Location of special steam and compressed-air pumps underground, and support and covering of steam pipe and disposal of exhaust steam, location of sumps, use of siphons if any. Describe water cars and their use. Also note bore holes for draining an upper working into a lower one, stoppages of same, and methods of clearing.

Note occurrence of acid waters and their effect on pumps and pump columns, and methods of obviating same, *e. g.*, bronze valves and piston-rods, wooden pipe, and wood-lined iron pipe. Note effect of acid water on rails, miners' tools, boilers, etc. Special rail sections for use in mines with acid waters.

Compute amount of water pumped and note relative amount obtained from different parts of the mine. Note any surface work for lessening the amount of water coming into the mine, *e. g.*, drains, ditches, special channels for streams, etc.

*Sketch*: Bull pump, plunger and lift pumps, bobs, and details of column pipe, pump-rods and water car.

#### 6. TIMBERING.

Note method of supporting roof in breast with props, size of props, distance apart, method of setting props and wedging, use of props in robbing pillars, timbering of gangways, timbering of shafts. Note method of timbering large excavations for pumps, for stables, and at the foot of the shaft, use of cribs under heavy roof, timbering of roof-falls, building of brattice, air-boxes, and stoppings.

#### 7. EXPLOITATION.

Describe the general plan of working the coal seam, including development by sinking, driving of gangways and airways; opening and working of breasts, and finally system of robbing pillars. Make a plan of several chambers, and adjacent airways and gangways, indicating the course of the ventilating currents, and the transportation of the coal.

Note on sketch map of mine the main lines of transportation, ventilation, and drainage, and location of hoisting and ventilating shafts and pumps.

Note the organization of the underground working force and the duties of the several officers, foremen and bosses, and work and duties of the different

classes of workmen, viz., mine bosses and deputies, fire boss, driver boss, miners, laborers, pump men, timber men, track men, and other company men, drivers, runners, top and bottom men at shaft and planes, door boys, etc. Note relations of men to company and methods of payment by month, by day, by hour, and by contract, per foot of gangway, per car of coal, etc. Note the method of keeping time books, contract books, etc., and sundry accounts with men. Make an abstract of the ventilation law stating object of the several requirements of the law. Give abstract of mine regulations, comparing with above and give reasons for the several rules.

#### 8. SURFACE WORKS, SHOPS AND HOUSES.

Sketch map showing relative position of surface works, shafts, breaker, engine and boiler houses, shops, offices, dwellings, and other buildings; railroad tracks, switches, turn-outs, etc., tram-ways and roads, lines of steam and water pipes. Descriptions of above buildings, roads, etc., noting especially the location with reference to the shaft of the hoisting engine houses, of fan, of breaker, whether built over or connected by a trestle, of boiler house, and note precautions against fire and explosion. Sketches showing arrangement of blacksmith's shop, of machine shop, carpenter shop, etc. Description of the method of sharpening and tempering drills, picks and bits of machine-borers.

Work of machine shop, repairs to pumps and other machinery. Work of carpenter shop, making of cars and repairs to the same, etc.

Organization of surface force, outside foreman, weigh-master, clerk, engineer, etc.

#### 9. BREAKER.

Note construction of the dumping arrangements at the head of the shaft, and follow the coal through the breaker, making a scheme of treatment. Note shape and dimensions of screen bars, inclination and spaces between them; slope of shutes, dimensions of the various screens—mud screen, main screen, chestnut and pea screens, counter or pony chestnut and pony pea screens—length, diameter, details of the various segments, construction of axis bearings and driving ear, inclination of axis, construction of screen segment and method of attachment, sizes of mesh, and revolutions per minute. Also note the various shapes, whether hexagonal, circular or pentagonal, and the single and double jackets.

Note diameter and breadth of face, shape and size of teeth, and speed of "main" and "pony" rolls. Arrangement of picking shutes or "telegraphs," of slate shutes, slope for each size, connection with storage "pockets," disposal of culm and slate. Size and framing of pockets and of lump or steamboat shutes.

Sketch gates at loading shutes for cars, noting culm grating and disposal of culm and the washing device if there is one.

Sketch arrangement of railroad tracks for taking coal from the breaker. Note the grades to facilitate handling of railroad cars.

Note the arrangement of shafting, the mode of connection with the various screens, rolls, etc., the location of the engine, diameter and stroke and number of revolutions.

HENRY S. MUNROE,

*Adj. Prof. Practical Mining.*

PITTSBURGH, LUZERNE CO., PA.,

July 13, 1885.

Instead of making excursions to other mines by the class in a body, the students were sent singly and in small squads, being distributed through a large number of mines. By this arrangement the students had better opportunity for careful work, and saw the mines visited under much more favorable conditions than if they went in a body. Each student was assigned a special subject of study to be incorporated in his regular summer memoir. By this means much valuable and interesting data was collected concerning the more important mines of the region. Students were thus sent to the Central, Pyne, and Woodward shafts of the Delaware, Lackawanna, and Western Coal Company, to the Coal Brook, Pine Ridge, and Mill Creek mines of the Delaware and Hudson Canal Company, to the Old Forge, Central, and "No. 2" mines of the Pennsylvania Coal Company, to the Erie and Kingston mines of the Hillside Coal and Iron Company, and to the Briggs mines of the Lackawanna Iron and Coal Company.

On Monday, July 27th, the class re-assembled at Scranton and in the morning visited the Scranton Steel Works, where we witnessed the operations of making Bessemer steel and of rolling 120-foot steel rails direct from the ingot. The plant of these steel works is of modern construction and illustrates the latest and best practice in the manufacture of steel rails. In the afternoon we visited the works of the Lackawanna Iron Company, where we saw blast-furnaces, converters, and rolling-mills.

The next day the class started for Antrim, where a short time was devoted to bituminous coal mining—the students following the annexed scheme of study.

#### SCHEME OF STUDY.

##### DRIVING OF HEADINGS.

Describe method of driving gangways, cross-headings, and back-headings, operation of "holing," or undercutting, and of "shearing" by hand and by machine. Describe "Harrison Mining Machine" and its work, as compared with hand labor, advantages and disadvantages. "Breaking down" of coal by powder or by wedges. Give inventory and sketches of hand and machine tools

used in driving headings. Description of work, time required for each operation, undercutting, shearing, breaking down, loading, laying tracks, etc. Number of men required, and work of each, length and number of shifts, and progress of work per shift and per month. Note methods of ventilating and draining headings.

#### MINING OF COAL AND ROBBING OF PILLARS.

Describe method of undercutting and breaking down coal as above, noting modifications made necessary or possible by greater width of breasts. Describe system of mining, noting width of "breasts," and number of breasts in a "range," and the relation of the breasts in a range to each other, the order in which they are worked, and the distance between working faces. Note thickness of pillars between ranges of breasts, and thickness of gangway pillars. Handling of coal and slate in breasts. Ventilation and drainage in breasts, methods of working breasts to the dip of the coal. Number of men employed in breast and work of each, number and weight of cars loaded per day. Precautions for safety of men, inspection and propping of roof, regulations concerning gas, if any. Method of controlling direction and width of breasts and preserving thickness of pillars. Use of compass. Note "slips" or "cleat" of coal and inquire concerning method of laying out workings by the slip, sometimes used.

Describe system of robbing pillars, with sketches showing method of attack, and details of the work. Precautions taken for safety of men, Handling of coal and slate. Ventilation of workings. Number of men, their duties, length of shifts, amount of coal obtained per shift, and percentage of the coal in the pillars obtained in robbing.

#### UNDERGROUND HAULAGE.

Describe cars used, dimensions, capacity, and weight. Size of wheels, manner of oiling, use of sprags or brakes, method of coupling cars. Observe and describe the system of distributing empty cars and collecting loaded ones. Describe and compare different systems of haulage used,—by mules, by locomotive, and by wire rope, noting length of road so operated, grades, with or against load, number of cars hauled per trip and per day. Number of mules required under different circumstances, and total number in mine. Describe underground locomotive, weight, dimensions, gauge of track, size of cylinders and stroke, diameter and number of drivers, and number of cars and total weight hauled on different grades.

Describe system of wire-rope haulage, details of driving engine, diameter of cylinders, stroke, speed, valve motion, and connection with sheaves. Describe construction of driving sheave, diameter, speed, etc. Note method of supporting and guiding ropes and passing curves, and sketch rollers and guide sheaves. Describe method of attaching cars to rope and of detaching them, and manner of crossing rope with cars when necessary. Number and total weight of cars hauled per trip, speed, and total hauled per day. Note system of signals, if any.

Handling of cars outside, method of dumping, weighing, and inspection of

coal. Sketches and description of screens. Method of loading and handling railroad cars.

#### VENTILATION.

Make a sketch showing the course of air through a section of the mine, and showing location of doors, stoppings, brattice, crossings, etc. Measure air currents and give quantity of air circulating in each split and inquire number of men at work. Note methods of measuring air and take water gauge. Note dimensions of airways, gangways, and cross headings. Note also and describe "brattices," "air-boxes," "air-bridges," or crossings, "slant batteries," single and double "air-doors," "safety doors," and use of "brattice cloth." Special methods of ventilating gangways, breasts, and advance headings. Method of regulating and dividing air currents.

Describe fan, diameter, size, shape, and number of blades, revolutions per minute. Determine cubic feet of air delivered and water gauge. Observe also shape of casing and of chimney, bearings of fan shaft, size, journals, and methods of lubricating and of avoiding heating. Note general characteristics of fan engine, size and speed, method of connecting engine with fan, steam pressure used and cut off. Inquire indicated horse power.

#### DRAINAGE.

Describe different methods employed for draining the mine. Natural drainage, grade and size of ditches in gangways. Special drainage levels. Drainage of "swamps," and dip workings by syphons, construction of syphon and method of operating same. Use of special pumps driven by steam or compressed air. Note occurrence of acid water and its effect on pumps and water pipe, and means taken to obviate same, viz.: bronze or wooden valves, pistons, piston rods, wooden or wood-lined pipe, etc.

#### SURFACE WORKS, SHOPS, AND HOUSES.

Sketch map showing relative position of surface works, engine and boiler houses, shops, offices, dwellings, and other buildings; railroad tracts, switches, turn-outs, etc., tramways and roads, lines of steam and water pipes. Descriptions of above buildings, roads, etc., noting especially the location with reference to the mine, of the engine house, of fan, of boiler houses, and note precautions against fire and explosion. Sketches showing arrangement of blacksmiths' shop, of machine shop, carpenter shop, etc. Description of the method of sharpening and tempering drills, picks, and bits of machine borers.

Work of machine shop, repairs to pumps and other machinery. Work of carpenter shop, making of cars, and repairs to the same, etc.

Note the organization of the underground and surface working force, and the duties of the several officers, foremen and bosses, and work and duties of the different classes of workmen, viz., outside foreman, weigh-master, clerk, engineer, mine bosses and deputies, fire boss, miners, laborers, pump men, timber men, track men, and other company men, drivers, runners, door boys, etc. Note relations of men to company and methods of payment by month, by day, by hour, and by contract, per foot of gangway, per car of coal, etc. Note the method of keeping time books, contract books, etc., and sundry ac-

counts with men. Make an abstract of the ventilation law, stating object of the several requirements of the law. Give abstract of mine regulations, comparing with above and give reasons for the several rules.

HENRY S. MUNROE,  
*Adj. Prof. Practical Mining.*

ANTRIM, TIOGA CO., PA., July 29, 1885.

On Friday, July 31st, the class disbanded. The following scheme was prepared to assist the students in writing their memoirs. Respectfully submitted,

HENRY S. MUNROE,  
*Adj. Prof. of Practical Mining.*

Columbia College, April 21, 1886.

### SUMMER SCHOOL OF PRACTICAL MINING.

#### MEMOIR.

Students of the Summer School of Practical Mining will be required to hand in to the Professor of Engineering, on or before October 5, 1885, a memoir on the summer work, embracing :

1. An outline of the work in the form of a brief diary, showing how each day was occupied during the session of the summer school.
2. A memoir, accompanied by sketches, describing the different mines visited in detail, and following the requirements of the several "Schemes of Study."
3. A memoir, on one of the following subjects from notes taken at one or more of the anthracite mines of the Northern Coal Field, the subject of the memoir and the mine or mines at which the notes are to be taken to be hereafter assigned to each student individually. The memoirs to conform to the usual requirements of the school as to size of paper, width of margin, etc. Memoirs with the sketches and drawings to be bound neatly with title and name of writer on the back. The sketches as far as possible to be on sheets of paper or tracing cloth the same size as the memoir paper. If possible secure tracings of actual working drawings and maps. In such case the binder should be instructed to fold such large tracings and bind them with the memoir.
4. The maps and computations of the mine surveys executed at Hibernia are to be handed in at the same time as the memoir, viz., Oct. 5, 1885. Each student is required to hand in a transcript of the survey notes, and a full set of plats and sections as required in the scheme. These survey reports are not to be bound with the memoir but handed in separately.

The special Anthracite Memoir will be upon one of the following subjects :

#### SHAFT SINKING.

*Location of shaft :* Preliminary considerations locating the shaft. Explorations and borings. Information obtained in the working of other veins, on the same or adjoining properties. Railroad and transportation facilities.

*Sinking of shaft* : Specifications for contracts. Bids. Preparatory work. Sinking plant, hoisting, pumping, and ventilating appliances, air compressors, shops.

*Sinking through sand* : Method of sinking, system of timbering, use of spiling and retaining boards. Disposal of water. Amount of water. Diary of work of sinking, including all accidents and delays.

*Sinking through rock* : Method of sinking and sinking plant. Diary of work.

*Timbering of shaft* : Method of timbering, with sketches showing notching of timbers, division of shaft, guides, pump-rods, and supports of pumps and column pipe. Also timbering of gangways at landings and bottom of shaft. Diary of work.

*Hoisting* : Cages, including "safety clutch," "bridle chains," "bonnets," "detaching hooks," "keeps," "gates." Method of running cars on and off cage, and of fastening them. Grading of tracks at top and bottom.

*Hoisting engines* : Dimensions, speed, and details of construction. Details of brake and reversing gear. Construction of drum. Indicators, tell-tales and other signalling apparatus. Details of foundations.

*Shaft Tower or poppet-head* : Construction, system of bracing and anchoring. Sheaves.

*Pumps* : Details of construction of pumps, column, pump-rods, bobs, etc. Installation of pumps.

*Pumping engine* : Design and details of construction, foundations, and connection with pump rods.

*Cost of shaft* : Cost of sinking, contract price and extras, company work. Cost of timbering. Cost of pumps, pump-rods, column pipe, and pumping engines, and installation of same. Cost of hoisting engines, cages, and installation and foundation. Cost of engine house and other surface buildings.

*Drawings* : 1. Sketch map showing by surface and underground contours, the configuration of the coal seam, dip, basins, etc., and their relation to the surface. 2. Sections of shaft, showing hoistways, airway, and pumpway, and installation of pumps, pump-rods, column-pipe, fan, and its connection with the shaft, and shaft house at top. 3. Details of timbering of shaft and of timbering in the coal seams near the shaft. 4. Details of pumps, columns, pump-rods, bobs, etc. 5. Drawings of cage and of standard mine car. Details of "keeps," gates, etc. 6. Drawing of shaft-tower, and of engine house, showing roof and foundation.

#### HANDLING OF COAL.

*Handling of coal in breasts* : Description and details of mine car, loading of cars, grade and character of tracks in breasts and conditions affecting the same. Handling of cars in breasts of steep pitch, devices for controlling cars on steep grades, and methods of hauling cars up steep grades. Other methods of handling coal in breasts of steep pitch, sheet-iron shutes, buggy roads, battery breasts, etc.

*Transportation to main gangways* : Distribution of empty cars and collection of loaded ones. Organization of trips, number of cars hauled at once and per per day. Number of mules.

*Counter-gangways*, and other branch roads and their use.

*Gravity-planes and engine slopes* : Planes, length, average slope and detailed profile, arrangement of tracks, latches, guides, rollers, safety gates, drags. Details of drum or sheaves at the top, details of brake and size of wire rope. Number of cars hoisted per trip and per shaft. If an engine plane, note size and character of the engines.

*Haulage in main gangways* : Description of road, character of track, average grade and profile of tracks. Organization of Trip. Track repairs. Accidents and delays. Duties of driver boy and runner, use of spraggs and methods of coupling cars. Number of mules required and cars hauled under different circumstances. Total number of mules in mine. Underground locomotive, weight, dimensions, gauge, size of cylinders and stroke, number of drivers and diameter. Number of cars and total weight hauled on different grades.

*Handling of cars at top and bottom of shaft* : Arrangement of tracks at top and bottom of shaft and grading of tracks to facilitate handling of loaded and empty cars. Number of men and their duties.

*Hoisting* : Cages, details of construction, including "safety clutches," "bridle chains," "bonnets," "detaching hooks," "keeps," "gates," and fastening of cars on cage. Details of hoisting engine and drums.

*Handling of coal and slate in the breaker* : Separation of slate from coal, on platform and in picking shutes. Construction and inclination of shutes and telegraphs for slate and coal of different sizes. Construction and framing of pockets for prepared coal.

*Transportation to market* : Dimensions, weight, capacity, and details of construction of the different types of railway cars used, and advantages of each type. Method of loading cars, arrangement of tracks and switches at breaker to facilitate handling of cars. Inspection, weighing, and shipping of coal. Transportation to market.

*Transshipment of coal* : Methods of handling coal at terminus, and along line of road, different methods of unloading cars, relative advantages of each. Coal-docks, and methods of loading and unloading canal boats, lighters, and other vessels.

*Water transportation* : Description of boats used for transporting coal, size, capacity, and cost. Canal boats, lighters, sailing vessels for coast trade and steam colliers for foreign trade. Amount of coal carried per trip, and number of trips per year.

*Cost of handling and transportation* : Including : 1. Cost of loading mine cars, with coal and slate. 2. Cost of distributing empty cars and making up trips. 3. Cost of haulage on main gangways. Haulage by mules and by locomotives compared. 4. Cost of handling at top and bottom and of hoisting coal, slate included. 5. Cost of transportation by rail, including total cost to market and cost per ton-mile. 6. Cost of transshipment by different systems. 7. Cost of water transportation. [All cost to be per ton of coal.]

*Drawings* : 1. Standard mine car, and details of underground track, frogs, switches, latches, turntables, etc. 2. Underground plane, plan, profile, details of sheaves or drum, and support of same, brake, guides, rollers, switches, latches, and safety devices. 3. Drawings of cage and details of safety devices



and keeps. 4. Shaft tower. 5. Standard railroad cars for different kinds of service. 6. Coal pockets; drawings of best types of pockets for local trade and for coal for railroad use. 7. Coal docks, general plan of shipping docks at terminus of railroad. (The docks may be shown by photographs if desired, details to be given in drawings.)

#### VENTILATION.

*Fan* : Describe fan, diameter, number, shape, and size of blades, revolutions per minute, details of casing, shape and dimensions of spiral, double walls, etc., and details of exit and inlet openings. Bearings of fan shaft, journals, methods of lubricating and of avoiding heating. Measure cubic feet of air delivered and velocity in uptake and as near fan as possible, take water gauge at fan door, and in mine if possible. Compute efficiency of fan, by following formulæ.

$$h = \frac{v^2}{g}$$

$v$  = tangential velocity of tips of blades, in feet per second.

$h$  = theoretical dynamic head of air, due to velocity of fan.

$g = 32.2$  ft.

$$h - h' = h''$$

$h'$  = height of air column in feet, used in overcoming resistance of mine, = water gauge in inches  $\times 6.5$ .

$h''$  = theoretical dynamic head left to give velocity of exit.

$$v' = \sqrt{2gh''}$$

$v'$  = theoretical velocity of exit.

$$Q = Av'$$

$A$  = minimum area of outlet to fan.

$Q$  = theoretical quantity of air delivered.

$$\frac{Q'}{Q} = \text{efficiency of fan.}$$

$Q'$  = actual quantity of air delivered, best measured in the several splits.

Measure temperature of air on surface, at bottom of downcast and in upcast, and give depth of shafts, and calculate correction due to differences in weight and volume. Examine outlet-area of fan, and note differences in velocity of current in different parts, if any.

*Fan engine* : Note general characteristics, dimensions, and speed, connection with fan, steam pressure, and cut-off determine or inquire indicated horse power and compare with horse power consumed by air current =  $Q \times (h' \text{ plus } h'')$ .  
 $\times 0.0808$ .

$$\frac{v'''}{2g}$$

$h'''$  = dynamic head to produce current found in upcast.

$v'''$  = velocity of current in upcast.

*Installation of fan :* Note position of fan, connection with air shaft, protection against fire, etc.

*Furnace :* Details of construction, dimensions, arrangement of grate bars, area and height of upcast. Measure temperature of upcast near furnace and at top, and determine amount of air discharged. Fuel consumed per day.

*Distribution of air :* Describe general course of air through mine, number of splits, where made. Measure air currents and determine quantity of air circulating in each split. Methods of controlling relative amounts in each split. Note dimensions of downcast and upcast, airways, gangways and cross headings; construction and use of "regulators," "brattices," "air-boxes," "air bridges," or "crossings," "slant batteries," single and double "doors," "safety doors," use of "brattice cloth." Note special methods of ventilating gangways, breasts and advance headings.

*Amount of air required :* Note number of men, boys, mules, lamps, locomotives, and other sources of vitiation, and inquire what allowance is made for each. Note occurrence of fire damp, and blowers of gas, and location in the mine, whether persistent or soon exhausted, and source, whether from roof, from coal, or from the bottom. Inquire additional amount of air in each split on account of gas. Note duties of fire boss and powers, compare ventilation law and mine regulations on the subject.

*Safety devices :* Note any safety devices about engine, fan, or furnace, also any supplementary ventilating arrangements, extra doors, etc., for restoring and regulating the air current in case of stoppage of fan, or other accident. Safety lamps, kind used, care of lamps, when used and by whom.

*Accidents :* Describe any recent accidents, mine fires, or explosions of fire-damp, when they occurred and how caused. Means taken to remedy the damage done and to guard against similar occurrences.

*Cost of ventilation :* Cost of ventilating plant and running expenses.

*Drawings :* 1. Fan, drawings showing details of construction of fan and connection with air shaft, in plan, elevations, and sections. 2. Furnace, plan and sections showing details of construction and connection with upcast. 3. Tracing of mine maps showing stoppings, air-doors, crossings, brattices, etc., in red; and course of circulation of air in mine, the different splits being distinguished by differently colored arrows. 4. Drawings showing construction of "brattices," "air-boxes," "air-bridges," or "crossings," "slant batteries," "air-doors," and "stoppings."

#### DRAINAGE.

*Source of the water :* Note probable source of water in mine, give section of overlying rocks and note porous or water-bearing strata in the same. Note surface topography and relations to the rocks overlying the coal. Note the location and extent of the outcrop of the water-bearing strata and probable extent of country which might be drained by, note pressure of quicksands or water-bearing gravels over coal, note presence of streams, swamps, or other surface waters and their relation to the outcrop of the coal or to the outcrop of porous and water-bearing strata over the coal. Note occurrence of fissured rocks, whether produced by the working of the coal seams or otherwise. Note the presence of abandoned or flooded workings in the vicinity.

*Means of lessening water :* Note surface works for draining swamps or diverting streams. Note adit levels for draining upper workings. Note underground dams or pillars of coal to keep out water from adjoining workings. Note "tubbing" or water-tight lining of shafts to keep out surface waters.

*Drainage of mine workings :* Note location of shaft with respect to the basins of coal worked and different methods adopted in each case for bringing water to the main pumps. Grade of gangways, size of water ditches, and cleaning of same. Note method of draining dip workings, by hand pumps, special steam or compressed-air pumps, siphons, or bore holes to lower workings.

*Acid waters :* Note occurrence of acid waters, and their effect on pumps and pump columns and methods of obviating same, *e. g.*, bronze or wooden valves, piston rods, pistons, etc., wooden pipe or wood-lined iron pipe. Note effect of acid water on rails, miners' tools, boilers, etc. Special rail sections for use in mines with acid waters.

*Pumps :* Describe pumps, pump-rods, bobs, column pipe, etc., and method of supporting the same, calculate weight of column pipe and water contained and weight borne by each stull or other support, calculate weight of pump rod and corresponding weight of water raised at each stroke, and compare with the weighting of the balance bob to equalize work of engine on up and down stroke. Note diameter and stroke of pumps, and number of strokes, calculate amount of water pumped and maximum capacity of pumps. Note relative amount coming from different parts of the mine, and compare total weight of water with weight of coal hoisted. Note duties of engineer and pump man, packing of pumps and other work required.

*Pumping engine :* Describe in detail the "bull" pump or other pumping engine, diameter, stroke, valve motion, and connection with pump rods, foundations of engine, etc.

*Special pumps :* Note design of special steam, compressed-air, or hand pumps, used under ground. The support and covering of steam pipes and disposal of exhaust steam.

*Cost of pumping :* Cost of pumping plant and installation, and cost of pumping. Duty of pumps.

*Drawings :* 1. Drawing of shaft showing installation of pumps and pumping engines. 2. Tracing of mine map showing lines of drainage, location of special pumps, siphons and bore holes, and of main pumps, showing also position of surface streams, swamps, etc., and of adjoining workings which may be flooded, or likely to become so, location of dams, and thickness of pillars of coal between adjoining properties. 3. Details of pumps, column pipe, pump-rod, and bobs. 4. Details of pumping engine. 5. Drawings of water car and bucket.

#### MECHANICAL PREPARATION OF COAL.

*Screening :* Note construction of the dumping arrangements at the head of the shaft, and follow the coal through the breaker, making a scheme of treatment. Note shape and dimensions of screen bars, inclination and spaces between them ; slope of shutes, dimensions of the various screens—mud screen, main screen, chestnut and pea screens, counter or pony chestnut and pony pea screens—length, diameter, details of the various segments, construction of axis

bearings and driving gear, inclination of axis, construction of screen segment and method of attachment, sizes of mesh, and revolutions per minute. Also note the various shapes, whether hexagonal, circular, or pentagonal, and the single and double jackets.

*Crushing* : Describe construction of crushing rolls, diameter, breadth of face, speed, shape and size of teeth, and method of replacing worn and broken teeth. Proportion of different sizes of coal and of culm obtained from each roll. Note how proportion of different sizes can be changed according to demands of market.

*Separation of slate* : Note the separation of slate on the platform and in the different picking shutes before and after crushing of coal. Describe mechanical slate pickers, note total amount of slate separated and remaining in the prepared coal. Note amount of coal rejected with slate. Obtain if possible assays of slate, bony coal, and coal, showing relative amount of ashes in each.

*Construction of breaker* : Describe framing of breaker, construction of pockets, lighting of breaker, window area, use of artificial light, location of engines, belts, gearing, shafting, etc. Precautions against fire.

*Loading and inspection of coal* : Describe the different types of railroad cars used and methods of loading the same, noting method of separating culm from prepared coal and describe gates at loading shutes. Note inspection and weighing of coal and shipping of same.

*Coal waste* : Estimate or inquire the amount of coal left in the mine in pillars, not saved by robbing, and lost by crushes and squeezes. Also the amount of fine coal sent out of the mine and separated in the breaker, and finally the amount of fine coal made in the breaker in the operation of crushing and screening.

*Cost* : Give cost of breaker and machinery in detail if possible, and cost of preparing coal.

*Drawings* : 1. Vertical sections and plan of breaker, showing framing, location of railroad tracks, and arrangement of screens, rolls, picking shutes, telegraphs, conveyors, elevators, and pockets. 2. Plan and side elevation of tip, bar screens, and platform, and details of same. 3. Rolls, plan and cross section, howing rolls and installation of same. Details of teeth, bearings, gearing, etc., 4. Mud screen, main screen, and counter and pony screens, plan and end view of each, and details of segments, of axis and bearings, etc. 5. Plan of picking floors showing screens and picking shutes. 6. Plan and cross section of pockets, showing framing and construction, and details of loading shutes and culm grating.

HENRY S. MUNROE,  
*Adj. Prof. Practical Mining.*

PITTSSTON, LUZERNE CO., PA.,  
July 21, 1885.

*REPORT ON THE SUMMER SCHOOL IN  
SURVEYING.*

*Prof. Wm. P. Trowbridge :*

DEAR SIR: I have the honor to make the following report on the second session of the Summer School of Surveying held last summer at Litchfield, Conn. In selecting a place for the summer school it was recognized, first, that the locality must above every thing else be perfectly healthful and free from any suspicion of malaria. Next it was thought desirable that the place should be cooler than New York. Both of these considerations pointed to a place at some distance from the city. Among the places suggested, Cooperstown, New York, and Litchfield, Connecticut, seemed to offer the greatest number of advantages. The preference was finally given to Litchfield, because it was found that at Cooperstown accommodations for so large a body of students could be had only in the town itself, in which case the work of surveying would have had to be done partly in the streets of the town and partly about a mile and a half from the village. There was also found to be in the vicinity of Cooperstown a very large proportion of wooded land, and many fine country seats, improved and highly cultivated land, both of which would oppose obstacles to the students' work and lessen the available area for their surveys.

At Litchfield a boarding-house of sufficient size to accommodate the class was found about two and a half miles from town, with surroundings admirably adapted to the work proposed. In this vicinity there was a large proportion of cleared land, mostly pastures and meadows, and with but a small proportion occupied by crops likely to be injured by students in their work. The wooded land, also, was so located as to interfere but little with the work. In addition to this the topographical features of the country were such as to give great variety to the surveys of the students, and abundant practice under most favorable conditions.

Board and lodging for the students, and rooms for lectures and office work, and for the storage of instruments, were secured at Mr. Horatio Benton's. This was a large boarding-house, with rooms especially arranged for summer guests, and with ample accommodation for all our needs. Mr. Benton was highly recommended as a host, and his experience in entertaining large numbers of guests during previous seasons seemed to warrant the selection of his house as a most desirable head-quarters, entirely apart from the advantages offered by the surrounding country for our surveys.

In some respects the selection proved to be unfortunate. Mr. Benton is an old man, irascible, and of domineering character, and, as it proved, somewhat deficient in tact, at least, so far as his relations with the students were concerned. An occurrence, harmless enough in itself, was magnified out of all proportion to its importance by his manner of treating it. A midnight prank of a few of the students, directed principally against some of the less popular members of the class, was taken as a personal affront by Mr. Benton. Instead of bringing the matter to the notice of the professor in charge, he had warrants issued, before sunrise, for the arrest of the students, and it was not until these warrants had been served, and over a dozen students placed under arrest, that my attention was called to the matter. The warrants were so drawn, either intentionally, or otherwise, as to involve costs to the amount of several hundred dollars, besides which Mr. Benton demanded a large indemnity himself. Under the circumstances, especially as it was found that there had been no damage to property, and that nearly all the men arrested were innocent of any connection with the disorder, it was decided best to allow the matter to come to trial, in spite of the scandal thereby occasioned. The result proved the wisdom of this course. The students were all acquitted, and the costs had to be paid by the town. The sympathy of the people of Litchfield was with the students, and Mr. Benton's course was severely condemned by his neighbors.

The difficulty of finding accommodations increases with the size of the classes. A single house as large as Mr. Benton's is rarely to be found. Even at Mr. Benton's a part of the class had to find accommodation at neighboring farm-houses. Hotels large enough for the class, in desirable localities, will generally be in a town of some size, when the surroundings will not be well adapted to the work of the class, and even if well situated are likely to be filled with other guests, making accommodations more expensive and producing complications. It is proposed, therefore, in the coming summer to try the experiment of camping out in tents or barracks.

The interference between the Summer School of Surveying and the Summer School of Mechanical Engineering, mentioned in the report of the President last year, is much to be regretted. As the two classes occur in the same summer, and as attendance on surveying is required, while the other class is an optional, the class in mechanical engineering must suffer, in spite of the fact that the surveying was purposely placed at the end of the summer, so that it would be possible for the student to attend both classes. To overcome this difficulty it is suggested that surveying be made optional to students of the first class, and that among the number applying such men be selected as are without conditions, preference being given to those who propose to attend the Summer School of Mechanical Engineering the following year.

Under the authority given by the trustees the following temporary assistants were appointed for the work of the Summer School :

Robert Van Arsdale Norris, '85,  
John Howell Janeway, Jr., '86,  
Henry Dunning Conant, '86.

The assistants added largely to the efficiency of the instruction, and, indeed, without them it would have been impossible to carry on the work of the School, with so large a class, on the plan of operations adopted. The number of instruments being limited, it was necessary to have them

all in use at the same time, thus increasing the number of surveys in progress, and making the course less progressive, both of which conditions increased the labor of the instructors. For example, at one time some students were engaged in levelling; and others in the preparatory adjustments of their instruments under the charge of Mr. Janeway; others were adjusting transits; and others engaged in reading angles under Mr. Conant; others again were running traverses or surveying mining claims under Mr. Norris; while other squads were making topographical surveys with the plane-table, under the direction of the Professor, who had in addition to exercise a general superintendence over the work of the whole class. Later the work of the instructors became even more complicated, as the number of different surveys going on at the same time increased. The assistants also proved most useful in the preliminary work, in getting the instruments and rooms ready for work, and in making the preliminary surveys as checks on the accuracy of the students' work.

The following students attended the Summer School of Surveying as required by statute:

E. Agramonte,	New York City.
J. C. Agramonte,	New York City.
W. H. Aldridge,	Brooklyn, N. Y.
H. M. Bell,	Staunton, Va.
H. P. Bellinger,	Elizabeth, N. J.
J. D. Berry,	Newnan, Ga.
J. R. Bien,	New York City.
A. L. Burns,	Brooklyn, N. Y.
E. Z. Burns,	Lockport, N. Y.
W. C. Butler,	Paterson, N. J.
E. D. Church,	Brooklyn, N. Y.
H. M. Cole,	Jersey City, N. J.
J. S. Cox, Jr.,	New York City.
H. G. Darwin,	Glen Ridge, N. J.
C. H. Davis,	Brooklyn, N. Y.
E. Frankfield,	New York City.
S. E. Gage,	Flushing, L. I.



A. M. Heinsheimer,	New York City.
A. W. Jenks,	Grand Rapids, Mich.
B. J. T. Jeup,	Brooklyn, N. Y.
A. Laist,	Cincinnati, Ohio.
L. Mc I. Luquer,	Bedford, N. Y.
H. S. Mackaye,	New York City.
H. C. Mannheim,	Brooklyn, N. Y.
J. R. Marsh,	Muncie, Ind.
J. A. Moorcroft,	Toledo, Ohio.
E. L. Newhouse,	Philadelphia, Pa.
H. P. Nichols,	New York City.
L. H. Norton,	Bridgeport, Conn.
H. H. Porter, Jr.,	New York City.
J. A. Primelles,	Puerto Principe, Cuba.
C. C. Restrepo,	Medellin, U. S. of Columbia, S. A.
G. S. Rice,	New York City.
G. Rowland,	New York City.
L. H. Rutherford,	New York City.
J. G. Seligman,	New York City.
F. P. Sherwood,	New York City.
F. M. Simonds,	New York City.
J. A. Staunton,	Syracuse, N. Y.
A. Stevens,	Hoboken, N. J.
F. W. Tower,	New York City.
G. F. D. Trask,	New Brighton, S. I.
W. L. Tyler,	Brooklyn, N. Y.
J. L. Warner,	New York City.
P. O. Wels,	New York City.
W. R. Wharton,	New River, Va.
Total, 46.	

Of this number twelve were members of the present fourth class, who had not completed their work the previous summer, or who had been found deficient therein. A number of conditioned men were excluded from attendance on the Summer School, and two men who were entitled to come absented themselves. The exclusion of part of the conditioned men was made necessary by the fact of there being an insufficient number of instruments; and the exclusion of these men seemed, moreover, justifiable for two reasons:

First, conditioned men are less likely to pass their delinquent examinations if the time required for preparation, and especially that just before the examinations, is occupied with surveying work ; and second, that many of these conditioned men do not intend to come back to the School, or are so heavily conditioned that they must in any case fall back into a lower class, with which they will have the opportunity of taking the surveying work in due time.

The result has proved that the above position was well taken. Of thirty-one conditioned men thirteen were allowed to join the surveying class, and eighteen were debarred from attendance. Of the eighteen men who were debarred, but one has been able to go on with his class, seven have been obliged to repeat the second year, and ten have left the School. Of the thirteen conditioned men who were given permission to attend, about half were unable to finish their surveying work, being obliged to suspend operations in order to prepare themselves for examination. The withdrawal of these men seriously interfered with the work of others who were working in the same squads with them, and introduced serious complications into the work of organizing the surveys during the last two weeks of the School. It was thought best, however, to excuse these men from further attendance, and they were even advised to go ; and it is doubtful whether they would have been able to go on with their class this year had they tried to complete their surveying work.

The following surveys and exercises were required of each student. The men worked as last year in squads of two men each, the system of small squads being extended even to the work with the plane-table, and with very great advantage.

1. Exercises, by the class in a body, for determining length of pace, and practice in pacing.
2. Survey of a field by pacing sides and diagonals, with the use of diagonal and rectangular offsets for detail.
3. Exercises in sketching contour lines, at first from relief models, and afterward on the ground. Two exam-

ples, of average difficulty were staked out on the ground, the levels of stations being given, and the students required to locate the contours and other topographical details by sketching, aided by pacing.

4. Exercises in chaining known distances over level and sloping ground, and in the construction of right angles and parallel lines with the chain.

5. Exercises in ranging straight lines with sight poles, in open country, past obstacles, between inaccessible points, by random lines, etc.

6. Exercise in reading compass bearings on the sides and diagonals of a regular polygon, for practice.

The above six exercises and surveys were made by the class in a body, under the immediate supervision of the professor and his assistants, and served as an introduction to the more difficult surveys which followed, in which the students worked in squads, over larger areas, and were necessarily thrown more on their own resources.

7. Survey, with compass and chain, of a farm of about twenty acres, including location of roads, fences, and farm buildings. and the correction of bearings for local attraction, the computation of latitudes, departures, and area, and the making of a plot.

8. Adjustment of the hand-level, and exercise in levelling.

9. Topographical survey, on the rectangular plan, the lines being run with the compass and chain, and the levels determined with the hand-level. Minor details by pacing and sketching. A finished map of the area surveyed was required of each student.

10. Adjustments of the transit.

11. Measurements of angles. As an exercise for practice in the use of the transit, and before undertaking more difficult surveys with that instrument, each squad was required to make three or four sets of readings of each angle of a triangle, each set including six repetitions.

12. Determination of the true meridian by observation with the transit on polaris.

13. Traverse of a polygon of about twelve sides, the

angles being repeated, and the sides measured with a 250-ft. steel tape, with allowances computed for catenary, temperature, and inclination, computation of ordinates and abscissas, and a plat.

14. Adjustment of telemeter wires and measurement of known distances with the telemeter.

15. Azimuth traverse of a polygon with distances by telemeter readings.

16. City survey.—Exercise in laying out city lots, and in determining exact position of house and fence lines. Report and plot.

17. Adjustments of the wye-level.

18. Line of levels, about one mile in length, with determination of the levels of stations 100 feet apart, and of bendees.

19. Plane table survey.—Each squad of two men was required to make a survey of about 70 acres, on a scale of 1 : 1000, sufficiently large to demand careful and accurate work. The work included the determination of all topographical details, natural and artificial, with the location of contours 20 feet apart.

20. U. S. mineral survey, with the solar compass, of a mining claim 150 feet by 1,500, complying in all details with the requirements of the Land Office, and with the instructions of the Surveyors-General.

21. Hydrographic survey.—For this survey the squads were increased to six men, and each squad was required to survey about 30 acres, making about 250 soundings, each sounding being located by two transits.

The mining claim survey was required of the students of mining engineering only, and the hydrographic survey of the students of the civil engineering course.

The importance and necessity for carefully kept note-books, containing a clear and accurate record of the work done, cannot be too much insisted on in surveying. The practice of examining and marking note-books daily, inaugurated in the Summer School of Practical Mining, was adopted also for the surveying class with very great success.

As was the case last year, accurate work was required of the students in their surveys. While the work of surveying was done in term time, in the afternoons only, and with frequent interruptions, the time and the conditions of work did not permit this requirement to be enforced. Rigorous accuracy is even now not insisted upon, except in one or two surveys, but the requirements in this respect are such as to ensure the work being done honestly, with care, and by the proper methods. Preliminary surveys are made so that the work of the students can be checked at frequent intervals, making it possible to detect promptly and to locate any serious error, so that the student is not required to repeat the whole survey, but simply that part in which the mistake has been made. The student, finding that any carelessness in manner or method of doing the work is promptly detected, is encouraged to greater care, while at the same time he is not discouraged, nor is his time wasted in doing again and again work with which he feels himself already familiar, and which he has already done with the required degree of care and accuracy.

With the requirement of accurate work the temptation to dishonest practices is, of course, increased, and the lazy student will seek to avail himself of the work of others wherever he can. Such practices are, however, almost sure to be discovered, and it is to be hoped that means may be found to prevent them entirely in the future. A dishonest surveyor, chemist, or engineer can do himself, his profession, and his employers incalculable mischief and damage, and such practices in a professional school cannot be too strongly condemned nor too carefully guarded against. In order to lessen the temptation to dishonest work the surveys of each squad are as far as possible made independent of all others. This, of course, throws much more work on the professor and his assistants in their preliminary and check surveys, but until a higher code of ethics prevails among students than at present, this extra work will be necessary.

In a previous communication the necessity for more in-

struments, and for repairs and alterations to those now in the possession of the department, was pointed out. In another communication the desirability of securing more permanent assistants was urged. Both of these wants have been met by recent resolutions of the board of trustees and their committees, and the prospect for continued improvement in the course of surveying with these added facilities is most encouraging.

Respectfully submitted,

HENRY S. MUNROE,  
*Adj. Prof. of Surveying, etc.*

New York, April 21, 1886.

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*REPORT ON THE SUMMER SCHOOL IN MECHANICAL ENGINEERING.*

*Prof. W. P. Trowbridge :*

I have the honor to submit to you the report of the Eighth Summer Class in Mechanical Engineering at the shops.

Recurring as this work does every summer, with the same objects and the same methods, it is impossible to add much in the way of new features of the work. The arrangement of examinations and the earlier date of Commencement this year admitted of an earlier beginning of work, and the class assembled on the morning of June 1st. The Delamater Iron Works, at West 13th Street and the North River, offered us the same hospitality and privileges as in previous years, and our entire visit was confined to those works. The same method of clinical instruction was pursued as in former years, the class assembling in a less noisy corner of the yard for a preliminary conference before studying at the tool or process itself. While this method is the easiest for the instructor, and is the only one where the class is large, I observe a tendency on the part of some of the learners to consider the talk the *principal* feature,

and that their duty is done if they have been present at that. This is to reverse the real idea, which puts primary stress on the study of the *thing*, the talk about it being of subsidiary consequence.

There was less work than usual in progress in some of the shops this year, the business depression affecting work in these departments very unfavorably. On some accounts, however, the tools being idle, their anatomy could be more readily studied than when the students would be in the way of hurried workmen. The dull season was also utilized to rebuild certain furnaces and other apparatus, which the students could inspect. The foundry was in full operation, however, and as profitable for study as ever, and the contract work was brisk and active. The class this year was particularly ambitious. In spite of the demand made on the vacation time by the Summer School in Surveying, and which I felt last year was such a barrier to the continuance of this class, I was obliged this year to apply the test of competition, as there were more than twenty men who sought to go with me. Twenty is the maximum number which it is convenient to take with me, and those are chosen from any greater number who may apply by giving the first chances to those who have passed all examinations without conditions into the third year of their course. More than the maximum twenty applied this year, and the discrimination had to be made. Last year, it will be recalled that the class was much smaller, and there was no occasion to make such a selection. I still made the concession to the shortened vacation of visiting but one establishment, and keeping the students only three full weeks. The class separated on Friday, June 19th, with warm expressions of the benefit which had been derived.

I feel inclined, therefore, to modify somewhat the adverse views expressed in the summary of the work of the previous summer, in view of the success of the work of the past summer. I suppose the course will be maintained as long as the demand for it by the students will warrant the sacrifice of time and labor which it entails at the end of a

season's toil. We were particularly fortunate in the coolness of the weather during the visit, which was of great help in preventing the decay of interest in a voluntary undertaking. For the present, therefore, I make no recommendations affecting the School, but leave this report in your hands.

An outline of study and a roll of class are appended.

Very respectfully,

F. R. HUTTON,

*Adj. Prof. Mechanical Engineering.*

Columbia College, October, 1885.

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## MECHANICAL ENGINEERING.

### SUMMER CLASS.

## SCHOOL OF MINES, COLUMBIA COLLEGE.

### NECESSARY OUTFIT

One pair outside calipers (4 inches).

One brass-bound rule (2 feet) graduated to 1-16 inch.

One pair blue drilling overall-pants.

One note-book (3 x 6 inches or over), pencil or stylograph.

### PLAN OF STUDY.

Each student will attend with note-book at the appointed shop, from nine to four.

He will study closely and critically the machinery, tool, or process which has been for that day the topic of the clinical lecture by the instructor, taking full notes and illustrating them with free-hand sketches, with DIMENSIONS IN ALL CASES. Where the object is inaccessible (*e. g.*, roof-trusses) estimate dimensions by eye, and write "approx." under the title.

Students will also seize every opportunity to draw and describe all details of engines and machinery in process of construction which are accessible to measurement. Such are—boilers, pistons, cross-heads, cranks, pillow-blocks, valves, wheel-arms, connecting-rods, eccentrics, stubs, governors, walking-beams, gal-lows-frames, propellers, paddle-wheels, and such engine castings as valve-chambers, cylinders, bed-plates, etc.

It is intended that these note-books shall be the first of that series which every engineer will have, containing memoranda and "studies" of parts of machinery and constructions to which he may refer in his practice. It would be well in the evening of each day to work over the sketches of the day at home into a clean note-book for more permanent preservation.



## OUTLINE OF COURSE OF STUDY.

### 1. BOILERS.

Describe the boilers : size, shape, and length ; how set ; grates ; domes ; tubes and flues ; size and height of chimneys ; courses of gases from fire ; diameter and length of steam pipe ; joints ; support ; lagging. Feed-pipe ; feed-heater ; blow-off pipe ; sizes ; valves and apparatus. Gauges. Pressures. Boilers over heating furnaces.

Study position of boilers with respect to :

- (1) Coaling and removal of ashes.
- (2) Delivery of smoke.
- (3) Condensation of steam.
- (4) Danger from fire and explosion.
- (5) Superintendence.

### 2. ENGINES.

Kind : size of cylinders ; Rpm., stroke, piston speed ; point of cut-off ; mechanism ; fly-wheel structure ; steam and exhaust pipe ; lubrication of cylinders and bearings ; governors ; condensers.

Study position of engines with respect to :

- (1) Distribution of power.
- (2) Ease of attendance, etc.
- (3) Duties of engineer.

### 3. DISTRIBUTION OF POWER.

Sizes, speeds of main belt ; sizes of main pulleys ; sizes, speeds, and location of main shafts ; couplings ; hangers : forms, intervals and lubrication.

Motion to shafts at angles ; use and structure of counter-shafts.

*Pulleys* : Sizes, faces, arms, securing, oiling, clasp-pulleys, guide-pulleys.

*Belts* : Kind, sizes, speeds, lacings, shifters, tighteners, open and crossed.

*Other transmissions*, by rope, chain, universal joints, flexible shafting, etc.

### 4. MACHINERY FOR HANDLING HEAVY WORK.

#### TRAVELLING CRANES.

Support of rails ; trussing of crane-girders ; spans ; speed of lift and of travel ; speed of driving rope, capacity ; gearing and tackle used ; proportions of parts ; method of driving and controlling crab.

#### PIVOT CRANES.

Location ; span ; height ; bracing ; foundation ; structure and movement of buggy ; hoisting-gear ; capacity and speed of lift ; men required. Power cranes, motions and control.

#### HOIST AND TACKLING.

Situation ; dimensions ; capacity ; construction ; handling.

#### TELEGRAPHS.

Fixed and pivoted. Trolleys and capstans.

### 5. CARPENTER AND PATTERN SHOP.

Study wood-working and machine-tools.

## 238 SUMMER SCHOOL IN MECHANICAL ENGINEERING.

*Saws* : Slitting cross-cut, band and jig. Lathes, speed and swing.  
*Planers, Matchers* : Bed, carriage and speeds, feeds and capacities of each.  
Study hand-tools—what are they and how used ?  
Shrink-rules ; glues and varnishes and their preparation.  
Division of patterns, dowels, core-prints, and core-boxes, draught.  
Draw-irons, system of storage of patterns.  
Elements of expense of patterns.

### 6. IRON FOUNDRY.

Size, shape, structure, foundations, lining of cupolas.  
Capacity, charging, lift, mixtures, starting fires, tapping, dropping out.  
Blast, pressure, how introduced, kind of blower.  
*Ladles* : Form, size, structure, handles, tipping-gear.  
*Sands* : Green, dry, facings, core-material, forming and baking. Washes.  
*Flasks* : Cope, drag or nowel, loam casting, sweepings, core-lathe, cleaning pickling castings, rumbles.  
Study processes of moulding, forming gates, and supporting cores.  
Study processes of casting, skimming, avoiding shrinkage strains and explosions.  
Notes times necessary and economy of close casting.  
BRASS FOUNDRY.—Alloys, moulds, furnaces, and crucibles.

### 7. FORGING.

HEAVY.—Furnaces, blast, hammers, anvils, and foundations.  
*Cranes* : Support, adjustment, and control.  
How large forging is built up and completed. Porter bar, time and men required. Upsetting, cutting off.  
LIGHT.—Forges, kinds of fuel and fires, blast.  
*Hammers* : Steam and power.  
*Hand-tools* : Sledges, hammers, anvils, tongs, swages, chisels, flatters, fullers.  
*Processes* : Heating, fluxes, welding, upsetting, scarfing.  
Tongue, scarf and butt welds. Drawing down, bending, cutting off, punching in small bars.  
Tempering and forging of steel.  
Flanging of plate— anvils, mauls, vises, fires, etc.  
Economy from close forging.  
COPPER SHOP.—Brazing, galvanizing, spinning, peining, babbitting.

### 8. BOILER SHOP.

Shearing, bevelling, marking, punching, drilling, boring, bending of plate.  
Riveting, by hand and machine, drifting, reaming, calking, expanding tubes, cutting off and heading over.  
Times required in each process.

### 9. METAL-WORKING MACHINE TOOLS.

Lathes—Drills—Vertical lathes and boring machines. Bolt threaders and nut tappers.

Planers—Shapers—Slotters.

Milling machines, gear cutters, profilers.

Emery wheels and grindstones, speed at surface. Buffing wheels.

Study :

(1) Motions of tool and work. How produced. Back-gear, cone-pulleys, quick returns. Rmp. and speed.

(2) Centring and chucking. Time required. Forms of chucks, face-plates, dogs and drivers, steady rests.

(3) Cutters—Forms, temper, cutting edges, spring, nature and weight of chips, inaccessible places. Rotary cutters.

(4) Tool-rests and holders—motions, methods and directions of feed, depth of cut, time to finish one square foot.

(5) Boring bars and heads, star wheels.

Roughing and finishing-cut. Water finish.

#### 10. BENCH WORK OR FITTING.

*Hammers* : Chipping by cold and cape chisels.

*Files* : Bastard, smooth, dead smooth, second cut, safe edges—Sections, draw-filing. Grinding, surfacing, marking, scraping. Tapping and pipe-fitting by hand and machine, dies and stocks.

#### 11. FLOOR WORK OR ERECTING.

Ratchet, hand and breast drills ; fly and twist drills.

Portable boring bars, mills and drills. Extensible and flexible shafting.

Standing bolts, socket nuts, wrenches.

#### 12. SUPPLY AND TOOL ROOMS.

Contents, system, repairs, gauges.

#### 13. DRAWING ROOM AND OFFICE.

Equipment and labor. Time-keeping. Account system. Paying. Shop rules. Contract system. Superintendence. Helper system. Laborer.

#### 14. GENERAL ENGINEERING FEATURES.

Sketch a ground plan of the plant (dimensions by paces) ; prepare, also, ground plans of each shop, showing position of each tool in it, with yard spaces and areas around each tool noted.

STUDY PRINCIPLES OF ARRANGEMENT OF BUILDINGS WITH RESPECT TO :

- (1) Transmission of power.
- (2) Progress of work through the shops.
- (3) Superintendence.
- (4) Ease of shipment goods.

STUDY STRUCTURE OF BUILDINGS WITH RESPECT TO :

- (1) Solidity to uphold shafting, etc.
- (2) Foundations and roof-trusses, floors, etc.

- (3) Combustibility in case of fire.
- (4) Windows, lighting and ventilation.
- (5) Convenient arrangement of tools.

F. R. HUTTON,  
*Adj. Prof. Mechanical Engineering,*  
*School of Mines, N. Y.*

ROLL, 1885.

Aldridge, A. L. Burns, E. L. Burns, Church, Cole, Davis, Heinsheimer, Jeup, J. Lahey, R. Lahey, Moorcraft, Restrepo, Rowland, Rutherford, Stanton, Stevens, Tower, Warner, Wels.

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## *REPORT ON SUMMER SCHOOL IN PRACTICAL GEODESY.*

*To the President of Columbia College :*

I have the honor to transmit herewith my report on the Summer School in Practical Geodesy. The class began work on June 1, 1885, at the observatory. Here two weeks were spent in teaching the class:—

- (1) To make observations for time and latitude with the sextant and artificial horizon, and to reduce such observations.
- (2) To make star observations for time with transit instrument, and to reduce the results.
- (3) To make observations with barometer, psychrometer, and thermometer, for determining height of observatory above level of 49th Street, and to reduce the results.
- (4) To make observations of angles with the sextant.
- (5) To make observations of angles with our 8-inch theodolite (direction instrument), provided with micrometer-microscopes, including determination and correction for "error of run."
- (6) To make observations of angles by the method of repetitions.

On June 16th, the class reported to me at Cooperstown, where the following indicated field work was accomplished:

- (1) Measurement of the base line of the Otsego Lake Survey, and reduction of the results.
- (2) Measurement of angles of the tertiary triangulation about the base line.
- (3) New stations selected, and new triangulation effected on the lake, according to the suggestion of Mr. Andrews, of the State Survey Office.
- (4) Barometric determination of the heights of several important points above surface of the lake.
- (5) Difference in level between railroad turn-table and a mark on the lake, by wye-level. This connects the lake surface with the levelling of the railroads.
- (6) Measurements of angles by direction instruments in the secondary triangulation back of the lake. One of the instruments used was loaned to me by the U. S. Coast Survey Office at Washington. This instrument had a graduated circle twenty inches in diameter, and was provided with three micrometer-microscopes.

The work of the triangulation of the Otsego Lake region has now been completed, except the direct connection with the State Survey triangles. The stations necessary to be occupied to make this connection are so far apart (some 35 miles), that it is not considered practicable to go on with the work in that direction for the present. The class disbanded on July 15th.

I enclose letters received from the State Survey Office in 1884. The work suggested in the letters was accomplished by this class.

Respectfully submitted,

J. K. REES,

*Professor Geodesy and Practical Astronomy.*

Columbia College, May 1, 1886.

NEW YORK STATE SURVEY,

ALBANY, May 12, 1884.

*Professor J. K. Rees :*

DEAR SIR:

I have, in accordance with your request, examined the field notes of the survey made under your direction by the

students, including the measuring of a base and making a triangulation of Otsego Lake. I referred the notes to Assistant Horace Andrews for a detailed report, which is herewith transmitted, and in which I fully concur. I earnestly hope you will fully complete the work and connect it with the State Survey stations. As you have but a few students this year, would it not be a good time to observe the long lines necessary for this connection? In such work, a small number only can be employed.

I hope to see your Summer School of Geodesy go steadily forward. A comparison of your survey of Otsego Lake with the old outline given in the maps will show to any one the value of your results.

Very truly yours,

JAMES T. GARDINER,  
*Director.*

N. Y. STATE SURVEY OFFICE,  
ALBANY, May 10, 1884.

*James T. Gardiner, Esq., Director New York State Survey :*

DEAR SIR: In compliance with your directions, I have examined the progress sketch of triangulation and field notes submitted to your inspection by Mr. J. K. Rees, Director of Columbia College Observatory, and representing the results of the work of his class at the Summer School of Geodesy.

The great care taken in base measurement could have been expected to give more accordant results between the first and second measurement. Perhaps this difference is due to the very high temperature of the apparatus at the time of measurement. It would have been advisable in the second measurement to have joined on to some of the stubs set during the first, thus giving a better means of judging of the precision of the results. It seems, however, that the mean value of the two results would have a probable error of only about  $\frac{1}{80,000}$  of the length of the base, which for

all practical purposes to which the triangulation may be put would be sufficiently small.<sup>1</sup>

Regarding the angle measurements of the triangulation, it is difficult to form a very exact opinion without considerable labor in tabulating the results and forming abstracts. I would recommend that such abstracts be made either in the field, which is the preferable plan, or as a first step in the reduction of the notes in the office.<sup>2</sup> The elements for reducing eccentric stations, etc., should be carefully preserved, and all resulting corrections entered in the abstract of horizontal angles. I can find no record of the distance, as one of the elements in reducing eccentric stations at "Tower" and "Camp Columbia."<sup>3</sup>

It would appear from a few triangle closures that the mean angle-error is about  $+5''$ , which is as good as could reasonably be expected with instruments reading to  $15''$  and with sights of only one or two miles. With a mean error of  $+5''$  the error in distance could not increase very rapidly, and the side "Drake-Clarke" should not have an error exceeding  $15.100$ . It would be well at the main stations, where the sights are of considerable length, to employ better instruments than ordinary engineers' transits, and to confine the hours of observation to those times when the signals appear steady.<sup>4</sup> Unless heliotropes are absolutely necessary their use will be apt to increase the error of angle measurement.<sup>5</sup> It is to be hoped that Mr. Rees may find it convenient to thus occupy the few stations connecting the Otsego Lake work with the side "East Hill-Summit," and to extend his small triangulation eastward from the base-line as far as station "Burton." A thorough check would thus be had on the results of the entire work, a check which would be especially desirable where the results of so many observers are to be combined.

The manner in which the small triangulation is connected with the base-line is especially worthy of commendation.

To perfect the connection between the small triangulation and the side "Drake-Clarke," a station might be placed nearly opposite "Tower" . . . to strengthen the con-

nection between the side "Camp Columbia Tower" and the work lying to the north, which is now only made by the triangle "C. Columbia-Tower-Morris."\* It would be well to take angles to the Cooperstown churches from at least *three* stations, to guard against possible errors arising from mistaken identity of points, etc. A great many other objects could doubtless be thus located by three or more cuts if advisable, and their positions would add to the interest and value of the survey.

Very respectfully yours,

HORACE ANDREWS,

*Assistant N. Y. State Survey.*

#### NOTES ON MR. ANDREWS' LETTER.

1. The base-line was remeasured during the summer of 1885, the measurement giving about a mean between the measurement of 1882 and 1883. This will reduce the probable error.

2. The abstract books are being prepared, and now that the work on the lake is finished, the reductions will be made as fast as possible.

3. The distances referred to were in the records and shown on the sketches of the stations referred to, but escaped notice.

4. The tertiary triangulations were made with Stackpole repeating theodolites reading by verniers to 15". The secondary work has, since the letter was written, been done with 8-in. and 20-in. direction instruments, provided with micrometer-microscopes.

5. Heliotropes were only used in the case of sighting through some woods and then mainly for instruction purposes.

6. This work has now been completed.

J. K. REES.



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## PRESIDENT'S REPORT.

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TO THE TRUSTEES OF COLUMBIA COLLEGE :

The President of the College begs leave respectfully to present the following report upon the operations of the institution during the year which is now approaching its close.

Scholastic operations for the one hundred and thirty-third year began on Monday, the fourth day of October. Entrance examinations had been held previously, beginning for the School of Arts on Tuesday, the first day of June, and continuing throughout the week ; and also subsequently in September, beginning on Tuesday, the twenty-seventh. For admission to the School of Mines, examinations were held in June, beginning Friday, the fourth of that month ; and in September, beginning the twenty-seventh.

Candidates for admission to the School of Political Science were received on Friday, the first day of October ; and for the Graduate Department, upon the same day.

Examinations for admission to the School of Law took place on Saturday, October second.

At the opening of the scholastic year all the officers were in their places ; Professor Alexander, who had been previously absent for more than six months on

account of ill health, having reported for duty with happily recovered strength. Mr. Bertrand Clover, who had been under leave of absence for three years previously, perfecting himself in the studies of his department in foreign universities, presented himself after a brief delay. Mr. Speranza, who, during the absence of Mr. Clover, had acted as instructor in Italian, retired from that position, but was continued on the list of teachers holding an honorary position.

The following officers, whose terms of service expired during the summer of 1886, were severally reappointed to the positions respectively held by them, to hold office during the pleasure of the Board :

Richmond M. Smith, Professor of Political Economy and Social Science.

Hjalmar H. Boyesen, Gebhard Professor of German.  
Guillaume A. Scribner, Instructor in French.

Benjamin F. Lee, Professor of Real Estate and Equity Jurisprudence, was reappointed for the term of one year.

Dr. Harry T. Peck, Tutor in Latin, was appointed to be Tutor in Latin and the Semitic languages.

Dr. A. V. W. Jackson, a prize Fellow in letters, whose three years' term expired in June, 1886, was appointed Assistant Instructor in the Department of English Literature, to give instruction principally in Anglo-Saxon.

Messrs. Hugo J. Walther, Thomas S. Fiske, Edward L. Stabler, Daniel K. Dodge, W. Creighton Spencer, Henry A. Short, and L. Harold Jacoby, were appointed Fellows in the School of Arts for the period of one year from the first of October, 1886.

From the graduating class of 1886, nominations to



prize fellowships were made by the Faculty of Arts, as follows :

Lincoln Cromwell for the Fellowship in Science ; Mortimer Lamson Earle for the Fellowship in Letters ; both to hold office from the first of July, 1886, for the term of three years.

James C. Egbert, Jr., a prize Fellow in the School of Arts, whose term expired in June, 1886, was appointed an Honorary Fellow, to hold office for one year from the first of July, 1886.

In the School of Mines a vacancy was created in the Department of Engineering by the resignation of Dr. A. D. Churchill. James L. Greenleaf, assistant in drawing in the same department, was promoted to the vacancy, to hold office for one year with the title of Instructor in Engineering and Drawing.

Ira H. Woolson was appointed to fill the vacancy created by the promotion of Mr. Greenleaf, also to hold office for the term of one year from the first of July.

Henry C. Bowen, Ferdinand G. Wiechmann, Hermann T. Vulté, and Charles E. Colby, Fellows in Chemistry in the School of Mines, whose terms expired on the first day of October, 1886, were reappointed, to hold office for the term of one year further, dating from the first of July, 1886.

Charles F. Lacombe was appointed a Fellow in Chemistry for the term of one year, to succeed Alfred L. Beebe, whose term of service expired by limitation on the first of October, 1886.

F. J. H. Merrill and James F. Kemp were appointed Fellows in Geology for the term of one year from the first day of July, 1886.

Subsequently, Charles E. Colby, one of the Fellows above named, in charge of the organic laboratory, was promoted to the grade of instructor, with the title of Instructor in Organic Chemistry, to hold office for one year from the first day of July, 1886.

Also Ferdinand G. Wiechmann, another of the Fellows above named, acting Instructor in Chemical Philosophy and Chemical Physics, was promoted to the grade of instructor, with the title of Instructor in Chemical Philosophy and Chemical Physics, for the term of one year from the first day of July, 1886.

In the School of Law, Paul D. Cravath, a member of the graduating class of 1886, was appointed, on nomination of the Faculty of the Law School, as Prize Tutor, to hold office for three years from the first day of July, 1886.

In the School of Political Science, Daniel DeLeon, Prize Lecturer appointed originally in 1883, whose term of service expired in June, 1886, was reappointed, on nomination of the Faculty, to the same position, to hold office for three years from the first day of July.

All these appointments were made at the final meeting of the Board for the scholastic year, 1885-86.

The following appointments were made later :

Nicholas Murray Butler was appointed a Fellow of the College, to give assistance in the Department of Philosophy, Ethics, and Psychology during the current academic year.

In the School of Mines, Henry Robart Porter was appointed Fellow in Geology in place of James F. Kemp, previously appointed but who failed to take office.

In the School of Arts, Robert Lawrence Allen was

appointed to fill a vacancy occasioned by the resignation of L. H. Jacoby, previously appointed to the same position.

William A. Dunning was appointed to fill a vacancy in the prize fellowship of H. H. Frost, resigned.

Dr. N. L. Britton, Assistant in Geology and Botany, was promoted to the grade of instructor, with the title of Instructor in Botany, and with the entire charge of the instruction in that subject.

Alexis A. Julien, Instructor in Microscopy and Micro-Biology, whose term of service expired on the first of October, was reappointed to the same office for the term of one year from the same date.

In the School of Political Science the following Students were appointed, on nomination of the Faculty of the School, to hold the scholarships endowed by Jesse Seligman, Esq., for the term of one year from the beginning of the current academic year :

John Greene, Henry Harmon Neill, Robert Weil, Walter F. Wilcox.

Nicholas Murray Butler, Fellow in Letters in the School of Arts, was promoted to the grade of Tutor in the Department of Philosophy, Ethics, and Psychology, the appointment to take effect from the first day of July, 1887.

Jasper T. Goodwin, Instructor in Mathematics, was promoted to the grade of adjunct-professor, with the style and title of Adjunct-Professor of Mathematics, the appointment to take effect July 1, 1887.

William Henry Stuart, C.E., of the class of 1886, was appointed Fellow in Engineering, to assist in instruction in drawing.

Richard J. H. Gottheil, of the class of 1881, subse-

quently Doctor of Philosophy of the University of Leipzig, was appointed Honorary Instructor in the Syriac Language and Literature.

Frank Drisler was appointed to be examiner at the entrance examination for admission to the Law School for the next ensuing year.

Michael Pupin, John Tyndall Fellow in Science, whose term of appointment expired on the 31st of December, 1886, was reappointed to the same fellowship for one year from the first of January, 1887.

One sad loss the college has been called on to deplore during the past year. At the opening of the session Professor Charles Short, of the Department of the Latin Language and Literature, resumed his place in apparently his usual health; but after a very few days he began to exhibit symptoms of failing strength, which were at first supposed to be only unimportant consequences of exposure to malaria. They grew gradually, however, more serious, until they interrupted his labors entirely, and arrangements were made to relieve him from duty altogether. No suspicion, however, was entertained of the seriousness of his malady, and although it was fully believed that he would be able to resume his work in the spring, the Trustees by resolution, on the 6th of December, granted him a leave of absence for the remainder of the academic year. To the surprise and sorrow, however, of all connected with the college, he declined from that time very rapidly, till on the 24th day of the same month his life was abruptly terminated. Resolutions were adopted both by the Board of Trustees and by the Faculty of Arts, expressive of the high sense of both those bodies of the personal worth, the learning,

the industry, and devotion to duty of this most excellent man and capable instructor, and of heart-felt condolence with his bereaved family.

The important chair which Professor Short has left vacant has not yet been filled ; but as earlier arrangements had been made, at the time when leave of absence was granted him, for the discharge of the duties of his office during the current year, his removal entailed no necessity of any immediate appointment. A large number of candidates, of well-attested ability, have been named to the Trustees for the vacant place, and it is to be presumed that a satisfactory appointment will be made before the close of the present year.

It is by statute made the duty of the President to report annually upon the manner in which the several officers of instruction in the different departments discharge their duty. He has had every reason to be satisfied with the industry, punctuality, and zeal of all the gentlemen engaged in carrying on the work of instruction in the several schools, and fully believes that no institution in the country is better officered or more faithfully served.

*Attendance : School of Arts.*—The number of matriculates in the School of Arts during the past year has been two hundred and thirty-seven, of whom fifty-two were Seniors ; fifty-one, Juniors ; fifty-eight, Sophomores ; and seventy-six, Freshmen. Of this number there has been but a single withdrawal, leaving therefore at the present time two hundred and thirty-six. If from this number we deduct the fifty-two Seniors about to graduate, there will remain on the roll at the close of the year one hundred and eighty-nine, against

one hundred and seventy-nine at the close of the year previous, showing an increase of ten.

Of the one hundred and seventy-nine on the roll at the close of the last year, there presented themselves for matriculation, at the opening of the following session in October, only one hundred and fifty-nine, showing a loss of twenty. The loss in 1885 from the same cause was eighteen; in 1884, twenty-two; in 1883, twenty-seven; and in 1882, thirty-five; showing a general diminution, though no material change has taken place within the past two or three years. The loss by withdrawing during the session has been, however, for the current year uncommonly small.

*School of Mines.*—There have been matriculated in this school during the past year, two hundred and sixty-four undergraduates, of whom eighty-eight were members of the first class; seventy-three were members of the second class; fifty, of the third class; and fifty-three of the fourth. There have become disconnected with the school during the year, for various causes, fifteen; leaving at present in actual attendance two hundred and forty-nine.

From this number, if deduction be made of the fifty-three members of the fourth class about to graduate, there will remain at the close of the year one hundred and ninety-six against one hundred and ninety-five in June, 1886.

*School of Political Science.*—The number of students enrolled in the School of Political Science during the present year has been seventy-four; of whom the first class has embraced thirty; the second, thirty-three, and the third, eleven.

*School of Law.*—Four hundred and nine students

have matriculated in the Law School during the year ; one hundred and sixty-four being members of the senior class, and two hundred and forty-five members of the junior class ; an increase over the numbers of the year preceding of eighteen Seniors and forty-seven Juniors ; or sixty-five in all.

Of this total of four hundred and nine, two hundred and eight, or more than half, were graduates of colleges, forty-nine different colleges having furnished one or more representatives each. Columbia College has contributed, as in former years, the largest number, being thirty-nine ; Princeton has furnished twenty-five ; Yale, twenty-three ; Harvard, twenty ; and the College of the City of New York, sixteen.

*School of Medicine.*—The number of students in attendance on the School of Medicine during the year has been six hundred and six. The students in this school are not classified.

*School of Library Economy.*—In this School, opened for the first time this year, the number matriculated has been twenty.

*Collegiate Course for Women.*—There have been twenty matriculates in this course during the year.

*School of Graduate Instruction.*—In this department, there have been twenty-six graduates pursuing studies under the direction of the Faculty of Arts, and six under that of the Faculty of Mines, a total of thirty-two. During the year preceding this total was twenty-four.

Summing up all the numbers above given, we obtain a grand total of sixteen hundred and sixty-two, but this must be reduced by deducting sixty for repetitions, so that the actual net total is only sixteen hundred and two.

## DEGREES CONFERRED IN 1885-86.

During the year ending in June, 1886, the following degrees were conferred :

I. IN THE SCHOOL OF ARTS.		Number.
Degree.		
Bachelor of Arts . . . . .		56
Master of Arts . . . . .		6
Doctor of Philosophy . . . . .		6
Doctor of Letters . . . . .		1
Doctor of Laws (honorary) . . . . .		1
Total . . . . .		70
2. IN THE SCHOOL OF MINES.		
Engineer of Mines . . . . .		15
Civil Engineer . . . . .		9
Bachelor of Philosophy . . . . .		9
Total . . . . .		33
3. IN THE SCHOOL OF POLITICAL SCIENCE.		
Bachelor of Philosophy . . . . .		4
Bachelor of Arts . . . . .		8
Doctor of Philosophy . . . . .		3
Total . . . . .		15
4. IN THE SCHOOL OF LAW.		
Bachelor of Laws . . . . .	110	110
5. IN THE SCHOOL OF MEDICINE.		
Doctor of Medicine . . . . .	97	97
Grand Total . . . . .		325

*Residences of Students.*—In the table which follows are exhibited the localities from which the students are drawn who resort to this institution, with the numbers contributed by each. It will be seen that, in the professional schools, most if not all the States and Territories of the Union are represented, with a sprinkling from foreign countries. The undergraduates in the School of Arts are mostly derived from this city or its vicinity. In order to show how far this is the case, New York, Brooklyn, and Jersey City are separately entered in the table, and the titles "New York State" and "New Jersey" are to be understood to exclude these.



# RESIDENCES OF STUDENTS.

Residence.	School of Arts.	School of Mines.	School of Pol. Sci.	School of Law.	School of Med- icine.	Gradu- ate De- partm't.	Course for Women.	School of Library Econ- omy.	Total.
New York City . . .	121	114	35	183	171	11	14	2	651
Brooklyn . . .	27	50	11	55	38	11			192
Jersey City . . .	6	6		5		2			19
New York State . . .	41	37	5	49	104	3	4	5	248
New Jersey . . .	33	29	5	41	80	2			190
Alabama . . .					1				1
Arkansas . . .					1				1
California . . .		1	3	8	6			1	19
Canada . . .				2					2
Central America . . .		1			4				5
Colorado . . .				1	2				3
Connecticut . . .	4			5	40		1	1	51
Cuba . . .		3			3				6
Delaware . . .					1				1
Dist. of Columbia . . .		2		1	2	1			6
England . . .								1	1
Florida . . .				1	1				2
Georgia . . .				1	5				6
Illinois . . .	2	4	3	5	4			1	19
Indiana . . .		1		1	5			1	8
Iowa . . .		1		1	4				6
Italy . . .				1					1
Japan . . .		1							1
Kansas . . .			2	7	5				14
Kentucky . . .				2	2				4
Louisiana . . .		3	1	2					6
Maine . . .	1		1	1	3			1	7
Maryland . . .			1	1					2
Massachusetts . . .		2	1	4	19		1	5	32
Michigan . . .		1			9				10
Minnesota . . .			1	2	7				10
Missouri . . .	1			1	2			1	5
Nebraska . . .					1				1
New Brunswick . . .					1				1
New Hampshire . . .					6				6
North Carolina . . .					4				4
Nova Scotia . . .					2				2
Ohio . . .		1	1	7	14	1			24
Oregon . . .					4				4
Pennsylvania . . .		2	4	9	10				25
Rhode Island . . .		1		1	13				15
Scotland . . .				1					1
South America . . .		2			5				7
South Carolina . . .				4	1	1			6
Tennessee . . .					2				2
Texas . . .					2				2
Turkey . . .					2				2
Utah . . .	1	1							2
Vermont . . .				3	4				7
Virginia . . .		1			7				8
Washington Ter. . .					3				3
West Indies . . .					1				1
West Virginia . . .					1				1
Wisconsin . . .				3	4			1	8
Wyoming Ter. . .				1					1
Totals . . .	237	264	74	409	606	32	20	20	1662

*Ages of Undergraduates in the School of Arts.—*

The average ages of the students matriculating in October, 1886, in the School of Arts, at the last preceding birthday of each individual, are exhibited in the following statement :

Class.	No. in Class.	Average age.	Oldest.	Youngest.
Seniors,	52	20 $\frac{3}{4}$	26	18
Juniors,	51	19 $\frac{7}{8}$	23	17
Sophomores,	58	18 $\frac{7}{8}$	24	16
Freshmen,	76	17 $\frac{1}{4}$	21	15

These results compare very closely with those given last year, when the average of the senior class was 20 $\frac{3}{4}$ . As these ages are taken at the beginning of the year, the average graduating age of the present senior class will be 21 $\frac{3}{4}$  years.

*Scholarship.*—It is only in the School of Arts that it is attempted, by affixing numerical values to the performances of students, to exhibit the relative standing of members of a class among each other in an order of merit. Such records afford a means of judging not only of the proficiency of individuals, but of the comparative scholarship of successive classes; and this makes it possible to draw conclusions as to the stability of the general standard of scholarship, or to detect fluctuations in that standard. With this view, the undersigned has been accustomed to present annually in his reports on the state of the college, statements exhibiting the average standing attained by the members of each of the several classes, together with the proportion in each who have reached an unusually creditable grade. Inasmuch as these reports are presented before the final examination in each year, it is impossible to give the results for the

entire year current. They are given for the first half of that year, and, for the sake of comparison, for the entire year preceding.

## NUMERICAL STATEMENT OF SCHOLARSHIP.

### FIRST SESSION—1886-87.

#### SENIOR CLASS.

Number in class . . . . .	44	
Number above 90 per cent. . . . .	17	
Number between 80 and 90 per cent. . . . .	17	
Number between 70 and 80 per cent. . . . .	8	
Entire number above 70 per cent. . . . .	42	
Average scholarship . . . . .		85.70 per cent.

#### JUNIOR CLASS.

Number in class . . . . .	42	
Number above 90 per cent. . . . .	18	
Number between 80 and 90 per cent. . . . .	15	
Number between 70 and 80 per cent. . . . .	7	
Entire number above 70 per cent. . . . .	40	
Average scholarship . . . . .		86.80 per cent.

#### SOPHOMORE CLASS.

Number in class . . . . .	47	
Number above 90 per cent. . . . .	9	
Number between 80 and 90 per cent. . . . .	21	
Number between 70 and 80 per cent. . . . .	9	
Entire number above 70 per cent. . . . .	39	
Average scholarship . . . . .		80.84 per cent.

#### FRESHMAN CLASS.

Number in class . . . . .	53	
Number above 90 per cent. . . . .	14	
Number between 80 and 90 per cent. . . . .	11	
Number between 70 and 80 per cent. . . . .	17	
Entire number above 70 per cent. . . . .	42	
Average scholarship . . . . .		80.42 per cent.

### SCHOLARSHIP—FOR THE ENTIRE YEAR, 1885-86.

#### JUNIOR CLASS.

Number in class . . . . .	50
Number above 90 per cent. . . . .	20

Number between 80 and 90 per cent. . . . .	15	
Number between 70 and 80 per cent. . . . .	12	
Entire number above 70 per cent. . . . .	47	
Average scholarship . . . . .		85.27 per cent.

## SOPHOMORE CLASS.

Number in class . . . . .	45	
Number above 90 per cent. . . . .	10	
Number between 80 and 90 per cent. . . . .	18	
Number between 70 and 80 per cent. . . . .	8	
Entire number above 70 per cent. . . . .	36	
Average scholarship . . . . .		86.98 per cent.

## FRESHMAN CLASS.

Number in class . . . . .	47	
Number above 90 per cent. . . . .	13	
Number between 80 and 90 per cent. . . . .	16	
Number between 70 and 80 per cent. . . . .	7	
Entire number above 70 per cent . . . . .	36	
Average scholarship . . . . .		81.33 per cent.

The foregoing statements of scholarship derive their significance from the hypothesis that it is possible to express numerically the relative value of the scholastic performances of different individuals, so as to exhibit their comparative merit. To this hypothesis many very decidedly object, for reasons which are not without plausibility. No quantity, it is affirmed, can be mathematically measured, of which the measuring unit is incapable of definition. But the value of a scholastic performance is a purely ideal quantity, the magnitude of which depends upon the imagination or the judgment of the examiner or critic, and which is almost certain to be differently estimated by different individuals. Suppose such a valuation to be placed at the number 6. The question naturally suggests itself *six what?* What is the unit of value? What kind of a performance would that be of which the value would be *one*? The question cannot be

answered ; but the explanation (a rather lame one) of the mark is, that it means six parts out of a quantity supposed to consist in total of a larger number, say 10. That is to say, a perfect performance would be marked *ten*, while a total failure, on the other hand, would receive the mark of *zero*. There is no difficulty about these extremes ; but when it comes to a valuation of six tenths or eight tenths of perfection, it is evident that there is large room for uncertainty and for discrepancy between judgments. Many instructors, therefore, are strongly opposed to the *marking system*, even while they use it ; on the ground that it involves unavoidably injustice to individuals, placing some above and others below the position to which their true merits entitle them. When, however, many individual results are combined, as in the foregoing statements of average class standing, the errors in opposite directions may be presumed to balance each other, and the general results are entitled to be received with some confidence.

*The Marking System.*—The discussion as to the expediency of maintaining, abolishing, or modifying what is called “ the Marking System ” has been going on in this college, and no doubt in many others, for years, without having reached any definite conclusion. The frequent use of the phrase itself, without definition, would seem to indicate that by “ marking system ” is meant some universally understood method in general use of estimating according to a numerical scale the relative values of scholastic performances. This, however, is hardly true. There are marking systems and marking systems. In fact, the use of some sort of marking system can hardly be avoided

while gradation in merit is attempted at all, even though it should be simplified to a mere arrangement of names in a certain order. In this case the "mark" is the place of the name in the numerical list. This is, in fact, in principle, the marking system as practised at West Point ; but it is not that, so far as the knowledge of the undersigned extends, of any system in use in any American or in any British college. The systems in actual use are various. It may be worth while to indicate their distinctive features. That which was found in operation in Columbia College when the connection of the undersigned with the institution began, consisted in a daily marking of every exercise, whether of recitation, composition, declamation, translation, mathematical solution, or written exercise, at a valuation proportioned to a given maximum according to the judgment of the instructor. The summation of all these valuations for an entire session gave what was called a *term-mark*. To this was added another value derived from the closing examination, having an effect on the final standing equal to that of the term-mark, and the sum of the two constituted the credit side of the account. But there was also a counter system of demerit marks, given from time to time for disdemaneors or peccadilloes, the sum of which at the end of the session was required to be deducted from the credit ; and the balance remaining determined the position of the individual in the general order of merit in his class. The working of this system in practice was attended with a good deal of inconvenience. In the first place, it assumed that every student should actually perform and receive a mark for every exer-

cise prescribed to his class ; otherwise the aggregate results in different individual cases could afford no fair basis for comparison. But in classes or sections of from thirty to fifty individuals, it is practically impossible to give each person an opportunity to be heard in the brief space of a single hour—the time usually devoted to a college exercise. Hence it will happen that, in such a class, a student may fail to be “called up” oftener than once out of three or four times. His record will therefore present a series of blanks, and the number of his actual performances will rarely be the same as that of others of his class. As the simplest way of correcting the consequent inequalities, the practice used to be to fill the blanks by allowing to each a mark deduced from the sum of those actually given, divided by their number, which was called “giving a man his average.” But this did not meet the whole difficulty. The average was given only for blanks occurring when the student was actually present and (ostensibly at least) prepared to perform. Other blanks, however, would from time to time occur, in consequence of *absences*, excusable or inexcusable. If the absences were excusable, as having been occasioned by illness or other cause beyond control, the blanks might be filled by “making up” the exercise (as it was called) to the instructor out of class hours. This imposed a tax upon the teacher’s time, which was occasionally very heavy. But if the absences were not excusable, each blank counted for a zero.

The faults in this system are obvious. In the first place it was a capital fault that it mixed up marks for scholarship with marks for conduct ; so that the re-

sults furnished no criterion of character, either intellectual or moral. On this account alone, the undersigned did not hesitate to condemn it at once, and this feature of it was immediately abolished. The system so modified continued to be maintained for several years; but it worked very heavily, and became after a time so unsatisfactory to both officers and students, that it was finally, in March, 1869, abandoned altogether.

As a substitute for the system abandoned, it was resolved that, from that time forward, standing in scholarship should be made dependent exclusively on the results of periodical examinations, to be held semi-annually. It was further ordered that these examinations should be conducted, wherever possible, in writing. Also, that in the examination papers periodically prepared, a valuation should be attached to each question or requisition set forth for solution, to be awarded for a perfect performance; imperfect performances receiving lower valuations according to the estimate made of their merit by the examiner. This, though not the "marking system" as it had been commonly understood before, was nevertheless a marking system of a simpler kind. It was the system used, and the only system used, in the British universities; with this difference, that while those institutions mark once for all, at the conclusion of the course, the marks here were given semi-annually, and the aggregates of all these semi-annual markings were taken at the close.

A little later this system received a still further simplification. Marks for particular performances ceased to be given; but every instructor was required



to make a monthly report, arranging the students in each of his classes in five groups, distinguished by the simple numbers, one, two, three, etc. Group I. embraced the students manifesting the highest degree of excellence. The other groups consisted of grades successively inferior, Grade V. being intended for the unsatisfactory or deficient. Here personal distinctions between the members of the same group were ignored. In the permanent record was entered opposite each name the number of the group to which it was assigned in each successive monthly report ; and at the close of the year, or of the course, the numbers opposite the several names were summed up. The smallest sum indicated the highest standing ; the largest sum, the lowest. Names having equal sums against them were bracketed together as of equal rank in the order of merit.

The officers in their monthly reports were to be guided in their groupings by the judgments they had been able to form of the comparative ability or proficiency of the students under their instruction, aided by any memoranda they might be disposed to keep of actual performances, to assist their recollection ; but they were to report no valuations of particular performances. To the undersigned this method of grading seemed to be less open to objection than any other which he had ever seen in operation ; yet, for some reason never distinctly avowed, but supposed to be the omission to distinguish differences of merit between the individual members of the several groups, it began, after a limited period of experiment, to breed discontent ; and in October, 1870, there was introduced a final modification of the system, giving

it the form which it has since maintained, and which seems to be as little satisfactory as any which has gone before. According to the present plan, the monthly reports of the instructors continue as under that which was abolished, but their form is changed, the classification by groups being replaced by a general list of names in the order of merit ; and the basis on which the arrangement is made being no longer the general judgment of the instructors, but the valuations given to the actual performances of the students in an examination held for this express purpose every month. The final order of merit for the year or for the course is obtained by combining the results of all the monthly examinations with those of the more general semi-annual examinations, giving to these latter a weight equal to that of all the preceding monthly examinations of the half-year. Under this system, if a student is absent from any monthly or semi-annual examination he suffers a serious loss, a loss which, however, in case the absence is excusable, he is privileged to make good by a special examination separately held.

The method here described works certainly with much less friction than the daily marking system formerly in use ; but it is open to some of the very serious objections which lie against that, and which must lie against every system according to which an order of merit is based on the numerical values assigned to the performances in written examinations. The first of these is that the scheme stimulates the ambition to secure favorable marks without awakening a corresponding desire to become possessed of the knowledge by which such marks may be fairly won.

To produce a performance which may meet the approval of the examiner is therefore the object of the student's highest endeavor, without regard to the means by which this object is accomplished. Hence the resort to dishonest practices, the use of which has been recently charged to be so general in other institutions as well as in this ; and which, there can be no doubt, is often attempted, whatever opinion may be entertained as to the extent of its success. There are those who have watched the operations of this system for many years, who are ready to declare it is a failure altogether ; and that even under it the highest academic honors have not seldom been secured by fraud. If the undersigned does not fully partake of these convictions, he has at least reason to believe that they are not wholly without foundation ; and he therefore regards the objection to the system well taken, that it does not accomplish the object proposed.

But a greatly more serious objection to it than its failure, is its demoralizing effect upon those who live under it. Whether the fraudulent practices which it is so positively asserted to encourage are successful or not, there can be no doubt that they exert a most deadening influence upon the moral sense of those who are tempted to employ them. So pernicious an influence steadily acting upon a susceptible youth at the period when character is forming can hardly fail to undermine his principles and destroy his sense of obligation in all the relations of life. It destroys, moreover, his sense of shame ; for while in its own nature cheating in an examination room is as essentially disgraceful, and is always so felt to be by an unsophisticated youth, as cheating at cards, yet a little

familiarity with the practices which young men tolerate among themselves in this matter so completely dulls their sensibility on the subject, that they cease even to affect concealment of their dishonesty, but rather plume themselves publicly among their fellows on their success. A system which naturally and, as it would seem, inevitably leads to consequences like this, is not one which can be wisely maintained in an institution for the education of the young.

The evils here spoken of owe their existence to the fact that examinations are in writing. Oral examinations afford small opportunity for imposing upon the examiner a show of knowledge where the reality does not exist. Even though the letter of a text may be correctly repeated, a few well-directed questions will quickly discover how far intelligence enters into the performance. If it be inquired then why examinations should not be made entirely oral, the reply must be that they were so half a century ago, and that the method was abandoned for what were then esteemed to be reasons of weight. Among these were the large amount of time necessary to make an oral examination thorough, when each individual of a class has to be separately taken up. The method is quite feasible for a single person or for a squad of two or three ; but with classes numbering from fifty to an hundred or upwards it becomes intolerably laborious. Another reason is that, in oral examinations, where all the students are examined in each other's presence, the tests cannot be identical to all ; and this, considering that the object of the examination is professedly to settle the question of comparative merit, is a fatal objection. It may indeed happen, and it is in fact an

occurrence which, while the system was in use, often did happen, that the least proficient man in a class, through the lucky chance which caused the most elementary matters to fall to his share, was enabled to appear to better advantage than the most thorough-going of his competitors.

Neither the oral nor the written examination seems, therefore, to be well adapted to secure the result which it is the object of either to attain, viz., the arrangement of the members of a class of competing students in a just order of merit. The question may then be very properly asked, whether this object is important enough to justify the trouble it costs to secure it. There can be no doubt that the educational effect upon young minds of a course of study would be much more beneficial, if the incitement to effort could be the love of knowledge for its own sake rather than the ambition to be publicly proclaimed as outranking their fellows in a scholastic roll. Why should there be any publication made as to scholastic merit except the distinction into classes of the *proficient* and the *deficient*? This is a question presented in the last annual report of the undersigned, and it is now repeated. The distinction here proposed is the only one made in professional schools, and it is the only one needed. In schools of the Liberal Arts, the order-of-merit plan seems to have been adopted in the belief that the spirit of emulation induced by it might stimulate diligence in study. Perhaps it does, to a certain extent, and among the ambitious and the limited number to whom high distinction is a possibility; but it is doubtful whether, among the great majority, this stimulus is felt at all, and it is not at all doubtful that,

among a large proportion, the influence of the system is discouraging rather than animating.

Should it be deemed advisable, however, to continue to maintain the traditional practice of grading classes in a regular order of merit, it would seem to the undersigned most judicious to entrust this arrangement either to the judgment of the officers having charge of the instruction of each class, to be made according to the impression produced upon their minds by the performances of individuals throughout the whole course of study, and not upon the basis of any system of numerical records; or, better than this, to leave this determination to the free suffrages of all the members of the class concerned, each student to form for himself independently an order of merit embracing the names of all his classmates, and a result or authoritative list to be deduced from the combination of these in the ordinary way of counting the ballots in an election. This method has the recommendation that it has been actually and successfully tried during a long series of years in one of the leading colleges of the country. During all the earlier part of this century, and down to some time later than 1830, no other method of determining academic rank was practised in Yale College than this. The ballot was resorted to only twice during the four-year course: once just previous to the Junior Exhibition, and again in anticipation of the final graduation; but it might be employed more frequently, if thought advisable. In the meantime, no record was kept of the relative standing of different individuals, and men were esteemed according to the reputation they established among their classmates, who were the observers of their diligence

and of the character of their scholastic performances. This system was abandoned at New Haven, not because of any distrust of its fundamental principle, but from the belief that the plan of giving a daily mark for every exercise would have the effect to keep the student more closely up to his work ; and hence the marking system was adopted. The two could not work together, and consequently the practice of voting was discontinued.

Two obvious advantages recommend the plan here proposed. It leads young men to prize the good opinion of their fellows, and to seek to be esteemed for real and not for a fictitious scholarship, represented by "marks" obtained often by methods of equivocal character ; and it trains young men in their early years to the use of those methods for securing success, on which they will be compelled to depend throughout all their future life.

Two objections have been made to the plan. First, it is said that young men will be biased, in giving their voices, by feelings of personal friendship or aversion ; and the vote will not be expressive of an honest judgment. Secondly, there are, at this time, so many distracting interests among college students, the offspring of their numerous petty associations, that class feeling is to a large extent subordinated to ambitions of a less comprehensive character ; in consequence of which the vote will be partisan ; and the result reached by it will be a triumph of factions, and not an expression of conscientious convictions. Both these objections are hypothetical. Long-continued experiment has proved that the first is baseless. The disturbing cause assumed in the second to be so dan-

gerous did not exist, or did not exist to the same degree, early in the century ; and what might be its influence can only be matter of opinion. A new experiment might very probably prove it to be quite inefficacious for harm. Such an experiment is certainly worth trying.

*Discipline.*—Under this head there is nothing to vary the monotony of the statements of the past several years. Good order and quiet attention to duty have become the rule among the undergraduates of Columbia College. It seems to be a truth generally recognized that to be a Columbian is to be a gentleman. The improvement in the tone of undergraduate sentiment on this subject within the past ten or fifteen years has been very marked ; and this is the case not in our institution only, but generally throughout the country. This effect has been doubtless due in a measure to the gradual outgrowing of pernicious traditions, according to which the experience of college life was held to be incomplete unless it had been marked by occasional scenes of turbulence and wild defiance of academic authority. In part, and in considerable part, it has also been further due to the substitution, to a great extent, of methods of moral suasion in place of the denunciation and infliction of penalties involving suffering or disgrace. But to these causes must be added the fact that, under modern academic regimen, the restraints upon the personal liberty of the student are vastly less than they were half a century or even a quarter of a century ago. The young man goes and comes, in college, almost as freely as in his father's house ; and though the old rules regulating his hours may remain nominally un-



changed, yet the consequences of their disregard have ceased to be serious, even if they have not ceased to follow altogether. Forty years ago, to leave the college ground during the prohibited hours drew after it grave censure, and to leave the university town without permission was an offence of such enormity as to involve dismission in disgrace.

The freedom conceded to young men in recent years, moreover, to organize themselves into voluntary associations, some of them secret and others open, for mutual improvement, for social enjoyment, or for the cultivation of athletic sports, has done much to soften what used perhaps to be felt as the iron yoke of academic rule, and to distract thoughts from grievances which were not the less irritating because they were usually imaginary. There can be no doubt that these organizations have afforded a salutary outlet for much of that youthful effervescence which might otherwise expend itself in disturbances of the general tranquillity. Those, therefore, who are disposed to regard with disfavor what they esteem the waste of time, and unwarranted interference with systematic study, occasioned by the recent large development of the system of inter-collegiate games and regattas, would do well to consider how very largely escapes through this channel an accumulation of explosive material, which, if less free to scatter itself, might produce results of a more serious character.

It was suggested in a former report of the undersigned that a remedy for the disorders from which colleges have at times so seriously suffered might be found by transferring to the students themselves the responsibility for their own government. The effect

of the system actually existing is to disguise to the mind of the undergraduate the fact that it is his own interest that is mainly concerned in the preservation of order. It is for him that the college is created. It is for his benefit that instruction is given. He is a member of the institution only in order that he may receive this benefit, and without quiet and good order the attainment of this object is impossible. But the tendency of the existing system is to fix in his mind the impression that the preservation of order is a thing which the teaching body aim to enforce for the sake of some advantage to themselves. In the spirit of defiance to restraint, which is natural to man always, and to young men especially, it occurs to him that to baffle them in this aim, if possible, is a thing rather creditable than otherwise. The experience, however, which young men in college have acquired, in the management of the voluntary associations which have so multiplied among them of recent years, has had the undoubted, though possibly the insensible effect, materially to modify their views of college government. And were the burden thrown upon them of seeing that the object for which the college was instituted is effectually carried out, there is no reason to doubt that the ends of good government would be quite satisfactorily secured—more satisfactorily, probably, than, in many instances in the past, it has been practicable to secure them.

These views were expressed hypothetically by the undersigned some six or seven years ago, at a time when he was not aware that they had ever occurred to others ; still less that they had been subjected to the test of experiment. He was very soon after in-

formed, however, that the plan of self-government by students had been in actual operation in one State university for ten years preceding; and since that time a similar system has been adopted with satisfactory results in Amherst College, and something analogous to it is on trial at Harvard. These beginnings in so conspicuous quarters betoken the coming of a new era in university government, in which college disturbances shall no more be known.

*Elective Studies.*—In Columbia College, at this time, the senior class are entirely free to choose the studies they will pursue from among all which are embraced in the general program. They are required to elect a sufficient number to fill up the prescribed number of hours per week. The junior class are required to study Latin, Greek, English, History, Political Economy, Logic, and Psychology, occupying two thirds of their time; and during the remaining third they may elect Mathematics, Physics, Botany, any one or more of the modern languages, and Latin or Greek in addition to that which is required. There are certain subjects, therefore, which are elective for both classes, and some which are elective for Seniors only. The following statement shows the manner in which the privilege of election has been exercised during the past year.

I. STUDIES ELECTIVE BY BOTH JUNIORS AND SENIORS.

	Seniors.	Juniors.	Total.
Number in class . . . . .	52	51	103
Greek . . . . .	27	7*	34
Latin . . . . .	20	18*	38
Mathematics . . . . .	6	15	21

\* In addition to this elective Latin and Greek, the same languages are compulsory upon the Junior class for two hours weekly each throughout the year.

Physics . . . . .	12	41	53
Botany . . . . .	9	18	27
French . . . . .	27	18	45
German . . . . .	10	22	32
Spanish . . . . .	6	4	10
Italian . . . . .	2	1	3

## II. STUDIES ELECTIVE BY SENIORS ONLY.

Number in class . . . . .	Number electing.
English . . . . .	52
Astronomy . . . . .	23
Philosophy . . . . .	39
Ethics . . . . .	20
Chemistry . . . . .	6
Political Economy . . . . .	8
Constitutional History of Europe . . . . .	15
Constitutional History of England . . . . .	35
Geology . . . . .	4
Anglo-Saxon . . . . .	11
Hebrew . . . . .	31
	6

## III. MODERN LANGUAGES ELECTIVE BY SOPHOMORES AND FRESHMEN.

	Sophomores.	Freshmen.	Total.
Number in class . . . . .	58	76	134
French . . . . .	29	37	66
German . . . . .	28	32	60
Italian . . . . .	1	0	1
Spanish . . . . .	0	3	3

The following exhibit shows the entire number of students from all the classes electing the modern languages severally.

## IV. TOTAL NUMBER ELECTING MODERN LANGUAGES.

	Numbers electing.
Total number of students . . . . .	237
Number electing French . . . . .	111
“ “ German . . . . .	92
“ “ Spanish . . . . .	13
“ “ Italian . . . . .	4

From an examination of these tables it will appear that the Italian and Spanish languages are sought by comparatively few. The reason of this is that those

languages, under existing rules—rules adopted in opposition to the advice and judgment of the undersigned—are not freely elective until the senior year; and that, when they become so, the time which remains to pursue them is not sufficient to allow them to be thoroughly studied. According to these rules, the student, at the beginning of the course, is required to take a modern language; but it must be either the French or the German—no other choice being allowed. He is further required to pursue the language selected up to the end of the sophomore year; and if, during the junior year, he elects any modern language, it must be that which he was previously pursuing, and which he is not permitted to relinquish till the end of the third year complete. The severity of the rule is relaxed only in case the entering student is already proficient in both French and German; or unless he can show that there are urgent reasons why he should make the acquisition of Spanish or Italian.

The adoption of these rules, which came first into operation during the academic year next previous to the present, has been very seriously to limit the scope and impair the efficiency of our system of instruction in modern languages. In planning this system, it was designed that the undergraduate instruction might progressively lead up to superior and postgraduate courses of philology and literature in each particular language; in order to which it was provided that choice should be entirely free among them all. This plan was adopted as devised, and was continued for several years successfully in operation. Since its modification, however, two years ago, the Romance languages of Southern Europe, and the Scandinavian

of Northern, have been so nearly excluded from the scheme, that they might almost as well be dropped entirely. It would be better, however, to rescind the rules which have operated injuriously, and to restore to the system the comprehensive character which was given to it in its first inception.

*Lenten Lectures.*—An interesting and gratifying incident occurred during the month of February last, which deserves mention in this report. A request signed by more than one hundred undergraduate students was addressed to the undersigned and to the Rev. Dr. Duffie, Chaplain of the College, asking that invitations might be extended to a number of distinguished clergymen of this city and Brooklyn, to deliver, on the successive Wednesdays during Lent, a series of brief ethical and religious discourses, in connection with the regular morning chapel services. This request was cordially endorsed by several of the Trustees, and also by all those members of the Faculty to whom it was submitted; and it need hardly be said that it was very willingly complied with. The consequence was that the student body were favored with a very interesting and effective series of discourses, which cannot but have been productive of very salutary impressions. The reverend gentlemen who kindly contributed to the interest of this series were the Rev. E. Winchester Donald, D.D., the Rev. George Van De Water, D.D. (of Brooklyn), the Rev. E. Spruille Burford, the Rev. William S. Rainsford, D.D., the Rev. Henry Y. Satterlee, D.D., and the Rev. Henry A. Adams. This incident suggests the possibility of instituting a permanent series of exercises of this character to cover a larger portion of

the year, and which would supply a defect in the moral and religious training of our undergraduates which is not at present adequately provided for.

*The Centennial Celebration.*—The present academic year has marked the close of the first century since the corporate body styled “The Trustees of Columbia College” was called into existence by act of the Legislature of the State of New York. It has been thought fitting to commemorate an event of so much moment by fitting ceremonial observances. Resolutions were accordingly adopted in December last, providing for such a commemoration, and appointing a committee to make the necessary arrangements. This report is not the place in which to give an account of the proceedings taken under this authority, or to go into details in regard to the ceremonial itself; but an incident so interesting in the history of the college can hardly be permitted to pass without a mention. The occasion drew together a body of men eminent in every department of intellectual effort, such as has been rarely assembled in this country in one place. Sister institutions in large numbers were represented by delegates selected from among the most distinguished members of their learned bodies. Throngs of enthusiastic alumni and undergraduates swarmed in procession along the streets and crowded to overflowing the capacious hall in which the exercises were conducted. A masterly oration by Frederic R. Coudert, Esq., of the class of 1850, followed by a poem by the Rev. George Lansing Taylor, of the class of 1861, held the immense audience in rapt attention; and the bestowal of honorary degrees in considerable numbers upon persons of recognized celebrity in letters, in science,

in education, in jurisprudence, in legislation, and in diplomacy, gave to the concluding ceremonies a kind of spectacular character, of which the interest was heightened by the infrequent occurrence of similar scenes.

A general reception given in the evening at the College by the President, Faculties, and Alumni, to the Trustees, invited guests, and distinguished citizens generally, was a most brilliant success. The buildings were illuminated throughout, and were thronged in every part to a late hour by curious guests. The reception took place in the great reading-room of the library, which had been cleared for the purpose of all furniture, decorated with flags, and lighted by electric lights, alternately white and blue (the college colors). A magnificent collation was spread in Hamilton Hall, and a lively band discoursed animating music to the young people who converted the lecture halls of the Law School into temporary dancing-rooms. It would be difficult to make a just estimate of the numbers assembled, but they would hardly have fallen below three or four thousand. Rarely, if ever, has a more numerous attended in-door fête been held in our city.

The impression produced upon the public mind by this demonstration, as evinced by the reports and comments of the press, and by the spontaneous expressions of gratification and hearty congratulations let fall in every quarter by our own fellow-citizens and by our distinguished invited guests from a distance, have been of a most favorable character. The celebration has awakened an interest in the college more general and more profound than has ever been felt



before, besides reviving in the hearts of alumni of many years' standing—some of them with heads quite silvered over—a new warmth of feeling toward *Alma Mater* not very unlike the glow of boyhood's time. Upon the whole the celebration has been a success in the fullest sense of the term.

*Free Public Lectures.*—During the academic year 1885–6 there was inaugurated experimentally a system of free public lectures to be offered to the public weekly on Saturday mornings, the lectures being voluntarily given by members of the corps of instruction. The experiment was made under unfavorable circumstances ; for, in the first place, the college is so unfortunate as to possess no lecture hall of dimensions sufficient to receive a popular audience ; and secondly, the lecturers were without means to give notice of the times and of the subjects of their lectures, except by advertising or by issuing tickets at their own expense. In their desire, however, to serve the college by impressing the public mind with a sense of its power of usefulness, and of its disposition to be useful, not only to young men under scholastic training, but to the people at large, they submitted to this tax, and a series of eight lectures was given in the lecture halls of the Law School on as many Saturdays during the spring of 1886. The success was beyond all anticipation. The halls, altogether too small for the purpose, were constantly filled to overflowing, and would have been had their capacity been twice as great. The approach of the final examinations of the year put an end to the course in May. It was resolved, however, to resume it on the reassembling of the College in the autumn ; but, considering the very obvious advantage to the

College from the maintenance of a system so generally acceptable, it was hoped the Trustees might be willing to make provision for defraying the inconsiderable but unavoidable incidental expenses attending it. As soon, therefore, as a proper program could be arranged, an appropriation for the purpose was sought, which was granted at the December meeting of the Board in 1886. The lecture course commenced on Saturday, January 8, 1887, and has been kept up without interruption to the present time.

Hardly had the course been commenced, than an unexpected embarrassment arose. A larger number of lectures were offered than there were Saturdays available during the remaining portion of the scholastic year. Some of these were disposed of by providing a secondary course of afternoon lectures on Thursdays. Others were necessarily declined, or postponed for delivery in a future year.

The lecturers have not all been college officers. In a number of instances literary gentlemen of established reputation have offered to contribute to the course one or more lectures freely; and their offers have been accepted so far as the limitations under which we have been operating have permitted. We have thus had lectures from Mr. E. S. Nadal, Mr. W. H. Bishop, the Rev. Mytton Maury, and Dr. Titus M. Coan; and we should have had several others, had not the time been previously engaged by our own officers. Of these, Prof. Charles Sprague Smith has given five lectures; Mr. G. A. Scribner, five; Dr. B. F. O'Connor, two; Dr. N. Murray Butler, two; Dr. H. T. Peck, one; and Mr. D. K. Dodge, one. The subjects of the lectures have been very various—liter-

ary, archæological, descriptive, psychological or pædagogical, and classical ; and probably the course has owed something of its sustained interest to this variety. That the interest has been well sustained is made manifest by the many and warm expressions of indebtedness to the college, which have been addressed to the undersigned, by many of those who have habitually attended the series, among whom have been ladies as well as gentlemen of high culture.

Similar expressions of appreciation have also been heard from the press of the city ; which, as is well known, usually occupies itself much more with the affairs of educational institutions at a distance than with those of Columbia College. Yet this lecture course has elicited in several quarters highly complimentary notices, of which the following, which appeared only a few weeks ago in a prominent evening journal, may be taken as a sample :

“ The rush of a great commercial city is apt to drown the voice of the muses. How many of our readers are aware that every Saturday morning at Columbia College a course of lectures upon literature and history is free to the public ? They are by various lecturers, the hour is 11.30 A.M., and the place is the lecture room of the Law building. Next Saturday, for instance, the lecture is by Dr. Titus Munson Coan, upon “ The Poetry of Wordsworth ” ; on the 16th and 23rd Dr. B. F. O’Connoꝝ will tell about “ The Song of Roland ” ; on the 30th Dr. H. T. Peck will consider “ The Argument against Classical Study.” These lectures, which are given weekly from January to April inclusive, would be a prominent feature in the intellectual life of perhaps any other college city in America. It is, of course, much too soon to compare them to the public courses at the Sorbonne and the College of France, in Paris, which are still,

after centuries of frequentation, one of the most attractive features of the most attractive city in the world. None the less our American Sorbonne is forming itself in East Forty-Ninth Street. These lectures are of real interest and value; and some of our wealthy men would not go amiss if they would provide a lecture room for their better accommodation. There are other courses of lectures given there which are also open to the public. In that of the Chemical Society of the School of Mines, connected with the college, Dr. John S. Billings's recent lecture on "Moulds," illustrated with lantern views and specimens, gave much curious information. In the course before the Columbia College School of Library Economy, Mr. Geo. Haven Putnam gave, on Saturday last, an interesting lecture upon "Literary Property from the Point of View of the Publishers." This will be followed by two lectures on "A Course of Reading," by Prof. R. C. Davis, Librarian of the University of Michigan; one on "Methods of Studying Literature," by Prof. Guillaume A. Scribner, and one on "Bookbuying and Bookbinding," by A. R. Spofford, LL.D., Librarian of Congress.

"Columbia College numbers, in all its departments, more students than any other college in the United States; the fact of its being in the largest and busiest city of the new world should not be allowed to obscure the scope of the work that it is doing. Surely these lectures are as well worth knowing about as the details of unimportant events. We commend them, and especially the course first mentioned, to such of our readers as may be interested in this very significant growth of culture among us. They mark a point in the slowly-accomplished transition of our community from material to intellectual interests."

It is here assumed that a scheme which has hitherto been regarded only as an experiment is an established part of our permanent educational system; and so it is evident we must now consider it. It has been too

complete and admirable a success to be abandoned. It is a success not only in the respect that it serves as an effective means of diffusing knowledge among the people, and of affording rational entertainment and solid instruction to the surrounding community, but as steadily drawing the attention of our fellow-citizens to the college, exalting their convictions of its usefulness, and awakening their sympathies in its behalf and stimulating their interest in its growing prosperity and their ambition for its higher development. On these accounts it is desirable not only that the system should be maintained, but that it should be expanded and made from year to year a more and more conspicuous feature in our educational scheme.

This conclusion forces upon our attention, however, the unfortunate fact that we are without any hall of assembly of such capacity as the satisfactory conduct of a system of popular lectures demands. The halls of the Law School will scarcely accommodate in their permanent seats more than about two hundred and fifty hearers; and though these have been supplemented by the introduction of camp stools, this expedient hardly suffices to provide for more than fifty in addition. On some occasions numbers have remained standing through the hour; and the crowds have invaded even the steps of the speaker's platform.

The immediate and pressing want of the college is therefore an adequate lecture hall; and it is a rather melancholy reflection that, while this want is so obvious and so urgent, it is impossible for us to turn to our fellow-citizens for help in this exigency with any confidence that our appeal will be heard. In this respect the case of Columbia College seems to be ex-

ceptional. Sister institutions, on the right hand and on the left, have, during the past twenty years, been flooded with rich gifts ; their grounds are dotted all over with buildings bearing the names of their generous benefactors ; Columbia alone has been hitherto overlooked by the living, and forgotten in their testaments by the liberal-minded capitalists who have passed away.

Not very long ago, the president of one of our more fortunate sister institutions, being on a visit to our grounds, pointing to the dilapidated edifice which, twenty years ago, was all that there was of Columbia College, inquired : " When are you going to take that away and put something better in its place ? " The reply of the undersigned was : " We are waiting for the financial tide to rise. " " There," rejoined the visitor, " is where we have the advantage of you. When we want a new building, we tell our alumni, and they give it to us. "

When the day shall dawn, if it shall ever do so, in which the trustees of our institution may be able truthfully to make the same remark, a new era will open on Columbia College, and she will go on rapidly to fulfil that manifest destiny which is certainly before her, and which will make her sooner or later the leading university upon the western continent.

*The Graduate Department.*—Seven years ago the Trustees of the college adopted the first of a series of steps which are destined to transform the character of the institution, and to lift it to a plane superior to that of a mere gymnasial training-school, which it had previously so long occupied. Once before, the effort had been made to give to the college at once the character

of an university. Thirty years ago, a new departure of this kind was attempted ; but the change was too abrupt and too large, and it was too much in advance of the public sense of the educational wants of the day ; hence its success was not encouraging. A series of measures was therefore resorted to, which, by giving progressive expansion to the scheme of educational operations conducted within the institution, has gradually led up to a point at which the transformation into a true university becomes natural and easy. With the original School of the Liberal Arts were associated, one by one, professional schools, beginning with the School of Law, established in 1858, followed by the School of Medicine by alliance with the pre-existing College of Physicians and Surgeons, in 1860 ; after which, in 1864, was added the School of Mines, designed at first for a special purpose, but which has since grown, without change of name, into a congeries of schools practically independent and no fewer than seven or eight in number. By degrees there subsequently arose a demand from a limited number of the graduates of these schools, or some of them, for more advanced instruction than was afforded by the regular curricula ; and some imperfect provision was made for the instruction of graduates. In order to encourage graduate study, there were established, as early as 1872, a number of Fellowships to be awarded to the most meritorious of the students annually graduating in the School of Arts, and these provisions had the effect to pave the way for the creation, by positive resolution in 1880, of an avowed department for the regular instruction of graduates, in which instruction is offered, and training in methods of research is

given, in all the subjects embraced in the general educational scheme of the institution. In the establishment of this department, it was not by any means anticipated that it would immediately attract a large attendance. There was a demand for the advantages it offers, but the demand was not great, though steadily increasing. The first graduate class, in fact, in 1881, embraced but six students. The number for the present year, as appears earlier in this report, is thirty-two. The growth has been quite equal to the anticipation, and is altogether encouraging. It is, moreover, quite legitimate to count in this department the students of the second and third years of the School of Political Science ; since that School is not professional, and the students of those classes are graduates. There are forty-four of them in all, which number added to that just given, swells the total to seventy-six.

That this superior department of instruction must constitute hereafter the main business of the College, becomes every day more obvious. The field is one which is not as yet in this city, or even in this country, adequately occupied. It is a field in which the importance of judiciously applied effort is every day growingly felt. Each year a constantly increasing number of young men are looking round for aids in the pursuit of knowledge superior to those which our colleges afford ; and each year sees a larger and larger proportion of them, dissatisfied with the imperfect facilities which they find at home, resorting to the great universities of Germany to obtain what they need. The students of the University of Berlin alone number at present more than five thousand ; and of



these several hundred are temporarily expatriated Americans. Leipzig, Vienna, Göttingen, Heidelberg, Tübingen, Bonn, and many others, draw also their considerable quotas of our youthful countrymen. This deplorable exodus can only be arrested by providing here the attractions which are so abundantly offered in foreign lands. These attractions will unquestionably be provided here at home, and in this city will be provided by Columbia College. It is a noble and magnificent task which our institution has before her, and it is one which will hereafter throw into shadow all that she has accomplished in her past honorable history.

An indication that our Trustees are beginning to be awake to the urgency and the importance of this task, is made manifest by the fact that there is now pending before the Standing Committee on the Course of Instruction, a resolution which suggests the immediate adoption of energetic measures to lift the whole plane of instruction here to the level of the university standard. The resolution even suggests, inferentially at least, the expediency of abandoning the undergraduate School of Arts entirely, and devoting the whole strength of the institution to its superior work. This, however, would be by no means a necessity. The maintenance of the inferior school would not in any manner interfere with the university system ; while it might rather aid the latter by serving to it as a valuable feeder. It might aid it also in another way. Since to discontinue the undergraduate department would cut off the revenue now derived from it, the Trustees, in adopting such a measure, must be prepared to relinquish a corresponding amount of their present annual

income. A better plan would be to retain this income, but to devote it to the maintenance of Fellowships to be bestowed on promising young men pursuing university studies. It is by some such measure as this that the success of the university system can be most certainly and most expeditiously secured. The Trustees of the Johns Hopkins University have recognized this truth, and have acted accordingly. The gratifying success which has attended the efforts of that corporation to encourage university study in this country, has been unquestionably attained by the creation of twenty Fellowships of the value of five hundred dollars each per annum, to be freely offered to graduates of all colleges equally, and bestowed on the most meritorious among the competitors.

The undergraduate department of Columbia College yields a revenue of thirty thousand dollars per annum. Were that wholly devoted to the support of Fellowships, it would maintain no fewer than sixty ; and the consequence would be the creation here of a nucleus which would draw around it in a very few years a student body rivalling in numbers some of the great universities of the European continent.

It is to be hoped that the committee who have in charge the resolution above referred to, may see their way toward recommending, as the first and most efficacious step toward advancing this institution to the grade of a true university, the establishment of a Fellowship system like this ; a system which, if not embracing at once so large a number as sixty, may at least be sufficient to compare favorably with the example set at Baltimore.

The value of the Fellowship system, not only to the

individuals directly benefited, but also to the scholarship of the country, may be estimated by considering the results which have been realized from the very modest provision of this kind made in our college some years ago. Under these provisions there have been appointed twenty Fellows, of whom twelve have completed the terms for which they were appointed. All of these, with the single exception of one whose career was prematurely cut short by death, have made themselves honorably known in the world, as scholars or men of science. Four of them are college professors (including one in our own college). Six others are instructors in colleges, of grade below that of professor, but admirably qualified for the higher rank which they are sure to attain. One of them is an able and well known writer in economics and social science. Three of them are oriental scholars who may claim to be authorities, and one is an accomplished educationist and metaphysician, who has just been placed at the head of an institution in this city recently established for the purpose of trying an interesting educational experiment of novel character.

It would be too much to say that these men would never have been heard of, or that they would have failed to attain distinction, if they had not received the appointment of Fellows in our college ; but it is quite safe to affirm that the kind of distinction which they have attained has been due to the bent given to their energies by the course of study to which their appointment introduced them.

A more indirect, and not entirely anticipated consequence of this same system of Fellowship appointments, has been the spontaneous growth here of an

incipient School of Oriental Literature and Comparative Philology. Among our young scholars selected for distinction as Fellows, it has happened that there have been several whose tastes led them to the study of the Vedas, the Avesta, the Hebrew Old Testament, the Talmud, the Koran, and other books not usually sought except by students of the philosophy of language. These, having become members of our teaching body, as assistants in the classical departments, have voluntarily offered their services to aid others to follow the same difficult path which they had themselves pursued ; and thus, without trouble or expense to ourselves, we have become possessed of the germ of a School of Philology which bids fair to reflect signal honor on the institution which has cherished it into life.

Very recently we have had an encouraging and flattering evidence that this promising beginning is not unappreciated by our surrounding fellow-citizens. Several friends of education especially interested in Biblical learning, at a recent meeting of our Board of Trustees, presented to that body through the reverend Rabbi Gottheil of Temple Emanu-El, a proposition to establish and maintain in the college a chair of Rabbinical Literature ; which proposition has been received with gratification, and referred to a committee to arrange the terms of the endowment. This very generous offer, it is hoped, will prove to be an indication that the wants of the college are beginning to be understood, and that the possibilities of its usefulness are likely to be materially enlarged by future benefactions of a similar character.

*The Library.*—The growing importance of the

library as an educational instrumentality becomes more manifest with each succeeding year. It has always been largely used by the students of the professional schools. It is still more so by those of the School of Political Science, and by the members of the Graduate Department. The methods practised in these Schools make the examination of authorities a daily necessity, and serve to test severely the sufficiency of our collections for the purposes of university study. The library is thus found, in spite of the large number of volumes it contains, frequently defective where information is most needed, and our students have been frequently driven, in many instances, to consult the richer collections of the Astor, or the Historical, library. This is a defect, however, which the progress of time will cure. Every year will add to the number of valuable books gathered here, and every year ought to do so, until there shall be no longer occasion to depend on the assistance of others.

This consideration brings into prominence the fact that the capacity of the present library building, considerable as it is, is not such as to permit any considerable further increase in the magnitude of its literary treasures. There remains but little space for shelf-room upon the walls still unoccupied; and there are books in large quantities piled on tables and floors, exposed to injury and accessible with difficulty, awaiting such accommodations as it is still possible to make for them, and which are now preparing. The old library hall, which is in communication with the new, contains many of these, and will perhaps for some time still continue to be necessarily used for this pur-

pose. On several accounts this arrangement is very undesirable. In the first place the old structure is not fire-proof; secondly, it is divided into a number of petty alcoves which impede rather than assist its usefulness; thirdly, it communicates with the main library through a crooked and inconvenient passage; and finally, it is without any means of artificial light except by portable lamps, the use of which in such a place, and with such surroundings, is dangerous in the extreme.

An extension of the library building is practicable directly toward the north, to cover the site of the old building, which must be demolished to make way for it; and which would furnish room for the convenient storing away of half a million volumes beside what we have at present, and would thus serve the purposes of the university for the next century. Such an extension would, at the same time, give to the observatory an increase of working space sufficient to permit the introduction of a dozen or more meridian instruments now greatly needed, and for which provision must somehow be made, if practical astronomy is to be taught to classes otherwise than in name. The enlargement suggested would involve an expenditure of possibly a quarter of a million of dollars; and would necessitate a delay of a few years in the extinction of the debt of the corporation, which would for the time being be more or less increased; but, in the opinion of the undersigned, it would in the long run be the truest economy to accept this temporary burden, which would not fail to bring with it advantages largely more than compensatory.

The enlargement of the library building thus sug-

gested would be attended with an additional advantage. The entire lower story of the extension can be devoted to the purposes of a lecture hall, of which the urgent need has been strongly set forth earlier in this report. The capacity of such a lecture hall might be made sufficient to accommodate from six hundred to one thousand hearers ; and thus quite a satisfactory provision would be made for this very important part of our scheme for university teaching.

The increasing use of the library by daily readers has been very noticeable during the past year. Although the number of tables is such as to provide facilities for seating nearly two hundred persons in the large hall, and sixty or seventy in the smaller rooms, at the same time, it not unfrequently happens that a place can scarcely be found unoccupied ; and occasionally every place is full. For more than a year past it has been the desire of the Library Committee to enlarge the accommodations for readers by flooring over the cases in the transept ; an expedient which would afford not fewer than fifty additional places for readers. This improvement has not yet been made, but the report of the Finance Committee presented to the Trustees at their last meeting proposes an appropriation sufficient for it, and it is hoped that it may be accomplished before the opening of another session.

### THE ASSOCIATED SCHOOLS.

*School of Law.*—The past year has been one of unusual prosperity in the School of Law. While there has always been a large attendance in this department, several causes have operated during the

past ten years to produce a gradual decline of numbers. The largest total of matriculates ever received in a single year was five hundred and seventy-three, the number enrolled in the year 1875-76. It was directly after this that the first check was given to the steady course of expansion, in the institution of an entrance examination. Up to that time, no educational qualification had been demanded as a requisite for admission to the school, and, as a consequence, many enrolled themselves who were hardly versed in the most elementary branches of knowledge. The entrance requisitions established at the time just mentioned were not heavy. They were only such as are imposed on candidates for admission to the Freshman class in college, less the Greek ; but they were sufficient to produce a sensible effect upon the number of matriculates.

A year or two later, a second and more serious check was put upon the growth of the school by new and more severe regulations established by the Court of Appeals governing admission to the bar. These new rules went legally into operation in October, 1877 ; but the school was relieved from their operation for a year or two succeeding, so that their effect on attendance was not immediately perceptible. Before the adoption of these rules, graduates of the law schools of the State, on presentation of their diplomas to the courts, were admitted to the bar without further ceremony. After their adoption, the candidate for admission was required, in addition to his two years' tuition in the school, to study or serve one year in a lawyer's office, which service could not be made synchronous with his school attend-



ance ; and he was further made subject to an examination by examiners appointed by the court. The diploma was thus deprived of a large portion of the value it had previously possessed, as a means of securing the status of a practitioner of law. The school being, therefore, no longer an open gate to the profession, was less sought, and the numbers diminished until, in 1885-6 (the last scholastic year), they reached the minimum of three hundred and forty-four. The tide seems now at length to have turned, the total attendance for the current year exceeding that of the year preceding by sixty-five ; an increase in itself sufficient to form a respectable class.

The long-talked-of measure of extending the course of instruction in this school to an additional or third year, designed to lead to the degree of Master of Laws, has been advanced by the report of a plan looking to that end. This, should it be found acceptable, will, it is to be hoped, be adopted ; or, if not, that some better one will be found ; so that our school may no longer continue to be the only prominent one of its class in the country in which the study of law as a science is not adequately provided for. An advantage of a more practical nature will also be gained in a probable increase of the revenue of the school by a material amount. There is little doubt that a third-year course would be eagerly sought by the more earnest of the students who complete the course for the inferior degree.

*The School of Political Science.*—The subjects taught in this school associate it naturally on one side with the School of Law, and on the other with the Department of Graduate Instruction. It is allied

to the School of Law, not in the sense that it assists the latter in training young men to be attorneys and to make the practice of law a means of subsistence, but in setting forth those broad and profound principles of jurisprudence by the just comprehension of which men are fashioned into scientific jurists. To the department of general university instruction, called by the Germans the Philosophic Faculty, it is allied, on the other hand, because the subjects of which it treats are also, so far as they go, the very subjects taught in that faculty ; and because they are taught in the broad and liberal sense, and without any immediately utilitarian object in view. The school has, however, a right to an independent existence, because it has a definite object, though not one utilitarian in its nature ; and it has a definite curriculum carefully contrived for the accomplishment of that object. Moreover, if the object is not utilitarian, it is, nevertheless, eminently useful, being nothing less than to produce men thoroughly trained and fully equipped for dealing with the most important questions which can concern the human race.

The school is steadily gaining upon the public favor, and more and more commanding the public respect. Its periodical review, called the *Political Science Quarterly*, mentioned in the last report of the undersigned, has taken rank at once as an authority on the subjects of which it treats, and is adding materially to the reputation of the school in which it originated.

There is no doubt in the mind of the undersigned that the prestige of the school would be materially enhanced if those 'of its very able instructors who

are now entitled lecturers merely, were advanced to the dignity of full professors. The subject-matters of which they treat appear to him to be sufficiently distinct and important to justify this change; in other similar institutions, as in Paris, they are assigned to professors; and the gentlemen themselves, by their personal ability, by their mastery of their topics, and by their long and faithful service, are eminently worthy of such promotion. It is hoped that this very desirable measure may not be long deferred.

*School of Mines.*—The first suggestion which it occurs to the undersigned to make in regard to this school, is that its title is a misleading misnomer which ought to be corrected. Nearly a quarter of a century ago, when, by the opening up of the rich mineral lands of the West, the mining industries of the country had received an extraordinary stimulus, and the number of those who were competent to direct them was very limited, it was represented to the Trustees of Columbia College that one of the most pressing wants of the time was that of an educational institution for the training of mining engineers. This Board was therefore urgently besought to establish a School of Mines—a School of Mines and that only. With some hesitation, and with very severe restrictions as to their own responsibility for the success of the venture, the Board consented. By a rather singular coincidence it happened that the connection of the undersigned with the institution began while this proposed School of Mines existed still only as a project. It became one of his earliest duties to see the project carried into execution. The school was first opened on the 15th November, 1864. Its earliest months

were months of great difficulty, during which it maintained but a very precarious existence. But for the earnest advocacy of the undersigned it would never have seen the end of its first year. But for the steadfast confidence of the undersigned in boldly staking on the issue all that he had to stake, his reputation as an educator, as a man of science, and as a man of practical common-sense, it would most assuredly have died without producing a single mining engineer. The struggle was a hard one; for the undertaking was regarded by the Trustees generally with marked distrust; and without their support it must hopelessly fail. They were at length persuaded to give it an experimental trial for a limited period; leaving its further maintenance contingent on the result. What the result proved to be is made manifest by the fact that the school exists to-day. The experiment was a success—more than a success—a triumph. It so surpassed the anticipations of the most sanguine among its early advocates, that, in less than three years, there was a demand for the increase of its usefulness by the expansion of its educational operations into other fields besides that to which in its inception it was originally confined. Hence the School of Mines, without any change of name, became also a School of Civil Engineering, a School of Metallurgy, a School of Geology and Natural History, a School of Analytic and Applied Chemistry, and later a School of Architecture, and a School of Sanitary Engineering. And still it advertises itself to the world as only a School of Mines; and still those in foreign countries, or in distant parts of our own, who know it only by name, think of it as nothing else.

It seems to the undersigned that it is time this error should be corrected. The name School of Mines should be confined strictly to that course of instruction to which it belongs ; and the congeries of courses now known by that name should be styled "The Department of Applied Science." In this department would then be embraced seven distinct schools, each as much entitled to an independent existence, and to a distinct recognition of its independent existence, as that which up to this time has absorbed them all into itself.

For the present, however, we must continue to employ the nomenclature which we find to exist. It may be said then of the School of Mines, meaning by this term the entire group of schools which have been distinguished above, that its operations during the year have proceeded satisfactorily ; with the exception of a little occasional friction growing out of the want of a perfectly well balanced scheme of attendance on the lectures, laboratories, and drawing academy. This want of equal adjustment has been the growth of years, and has arisen from the modification from time to time of the arrangements for the different courses severally, without fully considering the bearing of particular changes upon the system as a whole. As a result it has come to pass that the pressure of work on the students in some of the most trying courses has fallen unequally upon the different days of the week ; some of these days being overcrowded and others hardly filled up. Recently a committee of the Faculty has been appointed to rearrange the whole scheme, and by their labors it is hoped that the embarrassment complained of will be removed.

A very interesting portion of the educational work of the School of Mines is that which is done during the annual long vacation, in what are called the summer classes. The classes, some of which have been conducted annually for many years, were established for the purpose of giving opportunity to the students to acquire a practical knowledge of the operations of which the theory is learned in the school, by actually performing them with their own hands. During the summer of 1886 the number of these classes was four; by a recent act of the Trustees a fifth has been added, which will go into operation for the first time in June next.

*Summer Class in Practical Mining.*—The earliest of the summer classes established was that in practical mining. Its sessions have been held in different years in widely different localities, and have been devoted to the study of methods of mining in large variety, but principally those of the useful metals and of coal. The session of 1886 was held in the copper region of upper Michigan, head-quarters being established at the Atlantic mine, in Houghton county. For particulars of the work done, reference is made to the report of the professor in charge of the class, appended to this report. The assistants of Prof. Monroe during the session were Mr. Ira Harvey Woolson, Mr. James Jackson Ormsbee, and Mr. John Howell Janeway, Jr., the first being the regular assistant in drawing in the school, assigned to this duty by resolution of the Trustees; the others were temporarily attached to the service.

It is gratifying to learn from the narrative of the professor, that the visit of the class to the mine was

regarded by the proprietors and the managers rather as a pleasant interlude than as an annoyance. Such has been the account given in each succeeding year, and in every locality visited. This has contributed greatly to both the pleasure and the profit of the students, and makes it possible to believe that it will be long before we shall wear out our welcome to these interesting localities.

*Summer Class in Surveying.*—This class, on the work of which a report will also be found below, was held in 1886 in the same locality as in the previous year, viz., in the vicinity of the pleasant borough of Litchfield, Connecticut. The region is admirably adapted to the purpose, presenting extensive areas of cultivated meadow and wooded land, level and undulating, and well suited to practice in topographical work with the plane table. Head-quarters were pitched upon the borders of a beautiful sheet of water some miles in circumference, of which advantage was taken for prosecuting the work of hydrographic surveying. A summer resort hotel on the borders of this lake furnished to the class satisfactory board on favorable terms, and cheap wooden buildings, or barracks, constructed at their own expense, furnished lodgings, lecture- and drawing-rooms, and a convenient depot for instruments. So favorable on all accounts were the conditions of the locality, that it was resolved to make it the permanent scene of operations for successive years. The wooden structures above spoken of will therefore probably be enlarged to meet the growing wants of the class, and improved in their interior arrangements.

While referring to the report of the professor for

particulars as to the work of the class during the summer of 1886, the undersigned takes this occasion to say that the camp was personally and repeatedly visited by himself during the session. He carefully inspected all the arrangements, examined the work done, and informed himself of the methods pursued both in the field and at the quarters. The time of the students was divided between attendance on lectures, plotting and planning from field-notes and plane-table sketches, and active work in the field. It was to this last that the largest amount of time was given; and the work was followed up with an earnestness and assiduity of the most gratifying character. The field parties usually started out at a very early hour in the morning, carrying with them their noon-day lunches, and remained steadily at work until sunset. They were divided into squads of two or three each, some of them engaged in ordinary plane surveying, with chain and compass, or the more exact transit; some in plane-table sketching; some in running lines of level, and some in sounding on the lake. The important feature of the plan was that it enabled the student to pursue his work steadily and uninterruptedly from day to day and from week to week, until he could become perfectly familiar with all its details, and could feel the confidence in himself which the professional surveyor only attains after an actual experience of months or years.

Days unfavorable for open-air operations were utilized in finishing up plots and maps, of which a large number were accumulated during the summer, many of them beautifully executed. Records kept by the professor of the results of training to methods



of surveying without instruments were extremely interesting. One of these methods was the cultivation of an artificial *pace* as an unit of length for the measurement of long lines. Many different values have been given to this dimension at different times and in different localities, most of them greatly in excess of that which the word implies, viz., a step. The commonly reputed length in this country, which makes it equal to a yard, or three feet, is practically possible, but is too great to be maintained for any considerable distance without exhaustion. A convenient length is that of the Russian archine, twenty-eight inches, a good marching step, prescribed to his troops by Field-Marshal Suvaroff, whose saying is preserved: "An archine is the soldier's step." Thirty inches (two feet and a half) adapts itself a little more easily to our ordinary system of measures of length, and this is the length of the artificial pace to which the members of the surveying class have been trained. The records of practice referred to above are tables showing the difference between the results obtained by different individuals in the measurement of the same long distance, and their several errors as compared with the exact distance found by measuring with a chain. It is surprising to observe how small these differences become, after a few weeks of practice, making it evident that a survey executed by one of our young men entirely without instruments may be relied on as sufficiently exact for all practical purposes, unless where land is very valuable. On the whole, the impression brought away by the undersigned from his visits to this summer class was that its success has far out-stripped anticipation, and that

it is one of the most valuable additions which we have made in late years to our educational scheme.

*The Summer Class in Mechanical Engineering.*—

The exercises of this class were conducted in the summer of 1886, as in former years, entirely in this city, where only can be found the large workshops in which are carried on the industrial operations which it is their purpose to study. The class were kindly permitted to make their head-quarters at the great Delamater Iron Works, at the foot of Thirteenth Street, on the North River. The membership of this class is composed of the same men who, later in the summer, have to form the class in surveying; and hence the time occupied by it was reduced below what it has been heretofore, and the Delamater Works were the only ones to which special attention was given. The session was, however, an interesting and profitable one, for particulars of which reference is made to the report of Professor Hutton, appended below.

*The Summer Class in Geodesy.*—During the earlier part of the session of this class the students were detained in this city, and practised in the work of observation as conducted in fixed observatories. They were made to study the construction of equatorial and meridian instruments, the zenith telescope, the chronograph, and the clock, and to learn the handling of the instruments in actual observatory practice. After the completion of this introductory course, they were taken into the field at Otsego Lake, and engaged in the continuation of the trigonometric survey which has been carried on there by summer classes from year to year, and which, so far as that

locality is concerned, is now nearly completed. One important part of their work was the measurement of a new base line which may be taken as a base of verification.

Heretofore it has been a circumstance very advantageous to the class, that they have had the benefit of counsel and co-operation from the engineers of the official State Survey, with whose work it was expected that their own would be combined. It was an encouragement to the young men to feel that, in their operations, they were not only securing personal advantage to themselves, but were also contributing something of value to the public service. This incentive, by the discontinuance of the State Survey, has now disappeared. The record of the work which they have done about Otsego Lake will, however, be preserved; and, on the resumption of the public survey, which cannot fail to take place at no distant day in the future, it will find its place, it is to be hoped, in the publications of that important work. Further details as to the summer work of this class will be found below in the report of the professor in charge.

*Summer Class in Chemistry.*—The object of creating summer classes in any case, has been to supplement the regular scholastic sessions by affording opportunity for a kind of instruction which, though of great value, and in fact indispensable to thoroughness of attainment, cannot advantageously be given during term-time. In regard to field operations, as for instance in mining, surveying, and geodesy, the impossibility of pursuing them practically, while subject to daily interruption by lectures, laboratory work, and drawing, is obvious. In regard to chemistry this

is not equally apparent. Chemical analysis, however, especially analysis for quantity, requires for its satisfactory prosecution, an unbroken command of time, such as it is hardly possible to secure in the midst of the varied work of the general course of study. It happens frequently, therefore, that the students, at the close of the scholastic year, are found deficient in their quantitative analyses ; and that not on account of any fault of their own, but because of insufficient time free from interruption. For the sake of this class of delinquents, if for no other reason, the project of opening the laboratories during the summer, and of maintaining a special school of chemistry during the long vacation, has long been a subject of thought ; and this year, at length, the idea has culminated in action. By resolution of the Trustees adopted April 4th, it has been ordered that a Summer School of Chemistry be opened the 15th day of June next, to continue for three months, or till the 15th day of September.

But though it was in order to afford relief to the regular students of our school that this much-needed opportunity was provided to enable them to perfect themselves in the practical art of analysis, it is easily seen that this summer class may prove an independent boon to others, who, without the time or the means to pursue a full professional course, may desire to acquire a knowledge of practical chemistry only. Such persons cannot obtain admission to the school during term-time, it having long since been found impracticable to receive partial students into the school with due regard to the interests of the rest ; but the reasons which have necessitated the adoption

of this rule for the school do not operate in the case of the summer class. On the other hand no disadvantage need be apprehended from throwing this class freely open to persons properly qualified, who desire to enjoy its facilities only for the summer. That there are not a few who will gladly avail themselves of such a privilege, is made manifest by the fact that frequent inquiries have been made in past years for precisely such opportunities ; while it is known that there are many persons to whom the instruction they may receive here will be useful, and who have no other season but the summer in which to obtain it. Such are students of medicine, teachers in public or private schools, and some artisans who can better release themselves from their occupations during the period when business is less active than at other times. From these classes, the summer class in chemistry is likely to be largely recruited, and thus its usefulness may probably extend far beyond the narrow limit to which in its original conception it was apparently confined. How far these anticipations are correct will be experimentally tested during the course of the coming summer.

*The School of Library Economy.*—The value of public libraries as a means of diffusing knowledge among men, and as an educational instrumentality adapted to all classes of society and all ages, has of recent years been making itself steadily more and more felt. It has thus happened that the creation of new libraries is an incident of daily occurrence, until there is scarcely a village of a few thousand inhabitants in which such an institution is not in existence either actually or in project. With the multiplication

of libraries there has necessarily arisen a demand for persons competent to manage them. A collection of books, however large, is of little value unless they are so classified and arranged as to enable the seeker after knowledge who desires to turn them to account, to know precisely what they contain suited to his purpose, and how to lay his hand on it promptly. A circulating library, moreover, loses much of its usefulness unless it is administered according to a system which makes it possible to keep track of every book, so that if not on the shelves, it may on an emergency be instantly recalled. A well qualified librarian is therefore of as much importance as the library itself, and the librarian's office has risen to the rank of a profession.

Hitherto there has been but one mode by which an aspirant to this profession could obtain the necessary qualification. It has been to enter some existing library in a subordinate capacity and work his way up by observation and experience. This expedient is not universally practicable, and it involves at best a wearisome and usually protracted apprenticeship. Some three years since, the idea presented itself to the chief librarian of our college, who has given perhaps more careful attention to the systemization of library methods, and the definition of the librarian's duties, than any of his professional brethren, that a school for the education and training of librarians would open a useful career to many intelligent young persons of literary tastes, and would meet a very clearly ascertained public want. This thought was embodied in a formal written proposition addressed to the Trustees of our college and approved

by them in May, 1884. A resolution adopted on the fifth day of that month declared that a school should be opened in the college after notice of not less than two years, under the title of a School of Library Economy, and under the general direction of the chief librarian, who was at the same time invested with the style and title of Professor of Library Economy.

The conditions accompanying this concession were a little difficult. They were :

1st. That the conduct of the school should involve no expense to the corporation.

2d. That instruction in the school should be given by members of the library staff in addition to their ordinary duties.

3d. That the school should be conducted in the library building with such accommodations as could be found there.

On the other hand, it was permitted that a moderate tuition fee might be charged ; and that the proceeds from this source might be applied to any expense that might necessarily be incurred in the administration of the affairs of the school.

Under these conditions public notice was given that the school would be opened some time during the academic year, 1886-7 ; and the day of opening was subsequently fixed at the 1st January, 1887. Long before the day appointed, applications for admission began to drop in, and a problem presented itself which seemed likely to be embarrassing—it was how to find room for the numbers who might be expected. The supposition had been that the opening class would be so small that its members might be

distributed among the members of the library staff, except when assembled for instruction in common, on which occasions it was presumed that the librarian's office would afford them sufficient accommodation. Eight or ten at most were all that were looked for ; and all that, considering the experimental nature of the undertaking, were desired. The number of applicants was three times as great. By clearing out the old library hall, and pressing into service as furniture a number of discarded tables and desks, it became possible to provide with tolerable comfort for twenty. The rest were obliged to retire, which they did with some disappointment, but with the declaration of an intention to return the following year.

After the opening of the school, the time of the class was usually occupied during the forenoon with personal instruction given by teachers who passed from one to another of the students at their desks, explaining practical methods of work, and answering questions. In the afternoons, two lectures were usually given daily ; sometimes by the permanent teachers, and at others by eminent librarians, publishers, and others, whose sympathies with the objects of the school have led them to volunteer their assistance. It has been very gratifying to the undersigned and to those engaged in the immediate management of the school, to notice with what prompt and hearty goodwill all those whose coöperation has been requested in maintaining this system of lectures, have complied with the solicitation. There have been no fewer than thirty-six of these in all, of whom thirty were connected with important libraries ; among them the librarian of Congress, the librarians of the Boston



Athenæum and the Boston Public Library, the librarians of Brown and Michigan Universities, of Princeton and Amherst Colleges, of the Worcester, Chicago, and Providence Public Libraries, and of the Mercantile, the Astor, and the Free Circulating Libraries of New York. Interesting lectures have also been given by Dr. J. S. Billings, U. S. A., of Washington ; by Appleton Morgan, Esq., President of the New York Shakespeare Society ; by George Haven Putnam, Esq., publisher ; and by Gustav E. Stechert, foreign bookseller of this city. From among our own professors and instructors, bibliographical lectures have been or are to be given before the school on the subjects of their proper departments, by Professors Boyesen, Sprague Smith, R. M. Smith, Quackenbos, Price, Eggleston, Newberry, Carpenter, Britton, Butler, H. T. Peck, and Seligman. On the whole the series has been singularly instructive, and in this respect has far surpassed anticipation.

A fact exceedingly encouraging to those with whom this scheme originated has been the intense interest manifested by the students of the school in their work, and the untiring industry with which they have followed it up ; many of them often remaining at the library to a late hour of the night, engaged in writing up their lecture notes or in practising the methods taught in class. An evidence of their appreciation of their opportunities was early manifested in an unanimous petition that the school term might be extended a month beyond the limit originally assigned to it, which was from January 1st to April 1st. This comparatively brief period was fixed on and announced before the opening, in consideration of the fact that

the school was an experiment, the success of which was indeed hoped for, but was not certain. It was believed that, after a brief period of trial, we should be better prepared than we could be in advance, to lay down rules for the duration of the sessions, and the exact regulation of the course.

The experiment having proved to be an undoubted success, the undersigned ventures to present the following recommendations in its behalf to the favorable consideration of the Trustees :

1st. That convenient class and lecture rooms be set apart for the accommodation of the classes.

2d. That a form of diploma or certificate of proficiency, bearing the seal of the college and the signature of the president, be devised to be given to those students in this school who complete satisfactorily a definitely prescribed course of study, and fulfil such other conditions as may be imposed on them to that end.

Such a certificate would be of great value to the holder, and would enable him to command employment in any reputable library in the country having vacancies to fill. That this would be its undoubted effect is made manifest from the fact that, without any such diploma, persons employed in our library have been in constant demand for the last two or three years ; and many of them have been called away to positions much more advantageous than those they held with us. And it is now a curious and interesting fact that nearly every student in the class of the present year, although the course as set forth in the program is only half completed, has already received advantageous offers of permanent employment in

libraries elsewhere, some of which have been accepted.

*School of Medicine.*—The current year has been signalized by the enrolment in this school of the largest class ever received into it. The most notable event in the history of the year has been the final abandonment of the building in which the operations of the school have been conducted for the past thirty years, with a view to resume work in the fall in the new and spacious edifice in Fifty-ninth Street, erected by the liberality of the late William H. Vanderbilt. The college met for the last time in the Twenty-third Street building on Saturday, the 23d day of April, on which occasion an address was delivered, by request of the Faculty, by Dr. John C. Dalton, the President. The address was worthy of the occasion and was listened to with great interest.

This was the fourth time the college had changed its quarters. Its first course of lectures which commenced on November 7, 1807, was delivered in a small two-story building in Robinson Street. This was abandoned in the following year for a more pretending edifice in Pearl Street. In 1814 the school was again removed, this time to Barclay Street near Broadway; at which time it became associated with the medical school originally established by the Governors of King's College before the Revolution, and reorganized by the Trustees of Columbia College in 1792. This latter school was soon practically absorbed by its associate, and in 1815 ceased to exist. Some troubles subsequently arose which led at length to the resignation of the entire Faculty in 1826. A reorganization took place, however, somewhat later,

and in 1837 the college was once more removed, this time to Crosby Street, where it remained until 1856, on the 22d of January in which year the fine building on Twenty-third Street was first occupied, in which the last session was brought to a close ten days ago. In 1860, the School became the Medical Department of Columbia College. In its new quarters the school enters upon a period of increased usefulness under circumstances of the most encouraging character. Measures are at the same time being taken by its Faculty to raise the standard of intelligence on the part of the students, by requiring certain evidences of scholastic attainment as conditions of admission, and to insure the fitness of the graduates to practise their profession by making the final examinations increasingly rigorous. With this spirit on the part of the corps of instruction, and with the greatly improved conditions under which their labors will hereafter be prosecuted, it cannot be doubted that the School of Medicine of Columbia College will soon be recognized as the leading educational institution of its class on this continent.

*Conclusion.*—The retrospect of the year, except for the painful shadow which darkens its earlier portion, affords ample material for satisfaction and encouragement. That it has been a year in which a very large amount of solid and profitable work has been accomplished, an inspection of the papers appended to this report can leave no room to doubt. This, of itself, would perhaps be enough; but it is a source of additional gratification to be able to testify to the spirit of diligence in study, and of appreciation of the value of the opportunities here enjoyed, which has

almost universally characterized this large body of young men ; the kindly relations which have prevailed between them and their instructors ; and the cordial harmony of coöperation among these latter in the discharge of their common duties, a harmony which in any undertaking dependent on many wills is the condition indispensable to success.

The year has therefore honorably and nobly crowned the completion of the first century of Columbia College ; and it justifies the most flattering anticipations for its enlarged usefulness and steadily growing celebrity during the second century on which it is about to enter.

All which is respectfully submitted,

F. A. P. BARNARD,

President.

Columbia College, May 2, 1887.



## APPENDICES.





**APPENDIX A.**

REPORTS ON THE COURSE OF INSTRUCTION IN THE SCHOOL OF ARTS.

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DEPARTMENT OF GREEK.

*To the President of Columbia College :*

*The Senior Class*—Greek Section—has attended the Jay Professor of Greek two hours a week throughout the year, and has read the Olympic and part of the Pythian Odes of Pindar, with full explanations and illustrations from the professor on the subject-matter, dialectic forms, and style of the author.

The class has read also part of the Oration of Demosthenes on the Crown, with reference to the history of the times, political allusions, and explanations of legal terms and usages.

A section of the class has attended two additional hours per week through the year, and has read the Clouds and Frogs of Aristophanes, and eighteen Idyls of Theocritus.

*The Junior Class*, divided into two sections, has attended the Jay Professor of Greek two hours a week throughout the year, and has read the *Œdipus Rex* of Sophocles, with explanations from the professor of the grammatical and archaeological matters of interest connected with the play, the choral scanning, and the poetic value and style of the poet.

The class has also read about half of the *Protagoras* of Plato, and analysis of the dialogue and discussions on the life, teachings, and method of Socrates.

A section of this class has elected Greek for one hour a week, in addition to the above, and has read Plato's *Apology* of Socrates and *Crito*.

*The Sophomore Class*, divided into three sections, has attended the Adjunct Professor of Greek three hours a week throughout the year, and has read the *Iphigenia in Tauris* of Euripides, and a large part of the sixth and seventh books of Thucydides; of the latter so much as to give a connected view of the entire narrative of the Sicilian expedition.

Occasional exercises in versification and composition have also been held.

*The Freshman Class*, divided into four sections, has attended the Tutor in Greek three hours per week throughout the year, and has read the sixth, seventh, and eighth books of the *Odyssey*, and the greater part of the sixth book of Herodotus.

The class has also had weekly exercises in Greek syntax in Goodwin's Greek grammar, and exercises in Greek prose composition.

Dr. Perry reports that the progress of the class has been in the main quite satisfactory.

The volunteer class in reading has consisted of about twenty members from the different classes, and they have read the last nine books of the *Iliad* entire; the readings have been held twice a week.

*The Graduate Class* has attended the Jay Professor twice a week, and has read carefully eight books of Plato's Republic, and has made a full written analysis of each book when completed. The class has also read the first and second volumes of Zeller's History of Greek Philosophy, comprising Socrates and the Socratic Schools, and Plato and the Academy.

The Graduate Class has attended the Adjunct Professor of Greek one hour a week through the year, in a course of Greek Epigraphy. First the origin and development of the Greek alphabet was discussed; in connection with this the reading of fac-simile inscriptions, and the bearing of dialectic forms as occurring in inscriptions, etc., particularly the Doric and Ionic inscriptions, the Archaic inscriptions of the Ægean sea, those of Chalcis and its colonies in Italy,

and finally those of Attica. Roehl's *Imagines Inscriptionum Graecarum Antiquissimarum* has been used for the fac-similes, and each student has given an elaborate essay on one or more of the important Ionic inscriptions.

Respectfully submitted,

H. DRISLER,

*Jay Professor of Greek.*

Columbia College, May 16, 1887.

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### DEPARTMENT OF LATIN.

*To the President of Columbia College :*

I have the honor to present the following report of the work of this department for the college year now ending.

*The Senior Class.*—Twenty-one members of the Senior class elected the two-hour course in Latin, and during the year, read with me the *Trinummus* of Plautus, and twenty-five chapters of the first book of Cicero *De Natura Deorum*. In connection with the reading of Plautus, the class received instruction in Archæic Latin, in the prosody of the comic poets, and in the history of the Roman drama, both by lecture and otherwise. During the second term, lectures were given on the Philosophy of the New Academy with especial consideration of the Eclecticism of Cicero. Thirteen members of this class elected a second course of one hour per week, and read with me sixty-five pages of Ramsay's *Selections from Ovid*, including copious extracts from the *Fasti*, *Ars Amatoria*, *Remedia Amoris*, and *Heroides*. A course of lectures on the general principles of Philology was also given to this division of the class. Three members of the class elected a third course of one hour per week. These men read with me the whole of the first book of Lucretius *De Rerum Natura*, and the essential parts of the second book.

*The Junior Class.*—Latin being a required study in the Junior year, the entire class attended me for two hours each

week throughout the year. The first, third, seventh, tenth, twelfth and sixteenth Satires of Juvenal were read during the first term; and thirty chapters of Cicero *De Officiis* during the second term. In connection with the study of Juvenal, the class received much special instruction in the writing of Latin Hexameter verse; and made very satisfactory progress in the practice of verse composition. Lectures were also given on Roman Philosophy and the Eclecticism of Cicero. Eighteen members of the class elected a third hour of Latin, and read the *Andrian* of Terence, with a careful study of the ordinary metres of comedy. Much general information on the history of the Roman Drama and the Roman Theatre was imparted by lecture and otherwise.

*The Sophomore Class.*—Two sections of the Sophomore class attended Dr. H. A. Short throughout the year, and one section was under the instruction of the undersigned. The work of the year consisted of the first book of the *Epistles* of Horace, the *Agricola*, and a portion of the *Germania* of Tacitus; a critical review of the subject of Prosody; and (during the second term) prose composition in imitation of the author read by the class. Lectures on Roman History, Literature, and Antiquities were also given from time to time.

*The Freshman Class.*—The Freshman class, in four sections, has attended two hours a week each; and divided into two sections, one hour a week each. The reading of the first term was the first book of the Odes of Horace. The syntax of the moods was thoroughly reviewed and special attention paid to the lyric metres. In the second term the *Cato Major* of Cicero was read. Instruction in prose composition was also given. During the year several lectures were delivered upon Roman Lyric Poetry, and upon Cicero's Mission in Philosophy. Of the four sections of the class, Dr. H. A. Short had charge of one, Mr. N. G. McCrea of two, and Mr. M. L. Earle of one.

*Volunteer Class.*—A volunteer class for the practice of sight reading has met Dr. H. A. Short once a week through-

out the year, the work covering a large number of the epistles of the younger Pliny. Exercises in sight reading formed a part, also, of the regular work of the Sophomore class.

*Graduate Students.*—Three members of the Graduate Department have read during the year, the famous Second Philippic of Cicero with very minute and careful study of the history of the time, the condition of political parties at Rome, and the literary style of Cicero as exemplified in his oratory. The suspension of work in this section of the department during the illness of Prof. Short makes the amount of work accomplished less than that usually performed by the graduate students in Latin.

Respectfully submitted,

H. T. PECK,

*In charge of the Department of Latin.*

Columbia College, May 16, 1887.

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DEPARTMENT OF MATHEMATICS, MECHANICS,  
AND ASTRONOMY.

*To the President of Columbia College :*

I have the honor to report that the courses of study in this department have been carried on in accordance with the scheme prescribed by the Board of Trustees.

SENIOR CLASS.

1. *Popular Astronomy.*—This course is elective; it has been chosen by forty students who have attended me twice a week throughout the year. A text-book has been used as a guide, but the instruction has been entirely by lecture illustrated by more than three hundred lantern slides. The progress of the class has been tested by frequent examinations in writing, the results of which have been found satisfactory.

2. *Differential and Integral Calculus.*—This branch of higher mathematics was elected by eleven students who

have made excellent progress. The instruction has been by recitation and daily drill on the text-book, and in consequence of the small number in the class the drill has been thorough and efficient.

#### JUNIOR CLASS.

3. *Analytical Geometry and Mechanics.*—This course, which is elective, was chosen by fifteen students, or about 30 per cent. of all the students in the Junior class. These students have attended me three times a week throughout the year, taking analytical geometry the first terms and mechanics the second term. A text-book was used in each branch, but the course in analytical geometry was enforced by requiring the solution of a great number of illustrative examples, and the course of mechanics was supplemented by a weekly lecture illustrated by the models and apparatus with which the department is provided. The Schroeder models and the Willis apparatus have as usual contributed much to the success of this branch of instruction.

#### GRADUATE INSTRUCTION.

4. *Higher Mechanics.*—Two students, graduates of the class of 1885, continued the study of higher mechanics during the first term, having commenced the course at the beginning of the last academic year.

5. *Determinants.*—A class of five students, including the two just mentioned, studied the subject of Determinants during the first term.

6. *Modern Coördinate Geometry.*—During the second term three of the five students above mentioned studied the subject of Modern Coördinate Geometry, using as a text-book Smith's *Modern Coördinate Geometry*.

Respectfully submitted,

WM. G. PECK,

*Professor of Mathematics and Astronomy.*

Columbia College, May 16, 1887.

## DEPARTMENT OF MATHEMATICS.

*To the President of Columbia College :*

I have the honor to report that, during the past year, the Freshman and Sophomore classes have attended in mathematics as follows :

The Freshman class—four times in sections and once as a class, in all five times per week ;

The Sophomore class—once in sections and twice as a class, in all three times per week ;

and have accomplished substantially the course of study as contained in the Handbook of Information for the year.

The holiday given during the week of the commemoration of the one hundredth anniversary of the reorganization of the college, shortened somewhat the usual course in surveying—but this will be made good, to members of the Sophomore class who may desire it, by instruction in the field to be given by Mr. Goodwin.

The course to the Freshmen was slightly modified, with your consent, by introducing, in connection with their algebra, a brief course in the elements of determinants. This was given tentatively, and has proved of interest and advantage sufficient to warrant its continuance.

The examinations for prize scholarships, yet to be held, will be upon the work of the year, with the addition, for the Sophomore class, of Halsted's *Metrical Geometry*, and, for the Freshman class, of extra geometrical problems and applications of algebra to geometry.

At the beginning of the year, seven students entered the Graduate Department in mathematics. Two of these were, on account of the pressure of other duties, obliged to withdraw before the end of the first session ; the remaining five (one of them a resident graduate of the School of Mines) have attended me in two sections—each section attending two hours per week— throughout the year.

The first section (first-year students) have read the two volumes of Williamson's *Differential and Integral Calculus*.

Mr. T. S. Fiske, one of the Fellows in Mathematics, has, under my immediate supervision and with an occasional lecture from Mr. E. L. Stabler, another of the Fellows in Mathematics, conducted the lectures and recitations of this section with marked ability and success. If practicable, it would, in my opinion, be very desirable so to rearrange the undergraduate curriculum as to give students of the Junior and Senior classes who have a predilection for mathematical studies and a desire to pursue them, an opportunity to acquire as much calculus as is implied in the above course.

Messrs. Fiske and Stabler (constituting the second section), who were advanced to the degree of Master of Arts last year, have, in continuance of their mathematical studies, read the whole of Burnside and Panton's *Theory of Equations*, and much on the same subject in Salmon, Serret, and other authors. They have also read Hardy's Quaternions, and have, from time to time, given dissertations on topics assigned in connection with their reading. They deserve the highest commendation as students of mathematics and as assistants in the department.

Respectfully submitted,

J. H. VAN AMRINGE,

*Professor of Mathematics.*

Columbia College, May 16, 1887.

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### DEPARTMENT OF PHYSICS.

*To the President of Columbia College :*

The following is the report of the work done in my department in the School of Arts during the year:

#### JUNIOR CLASS.

During the first term the Junior class was engaged for two hours per week on the subject of heat, embracing: expansion of solids; liquids and gases; mercurial and air thermometers; conduction of heat by solids; liquids and; gases



tension of vapors; high and low pressure steam-engines; radiant heat; latent heat of liquids and gases, etc.

During the second term, two hours per week, subjects being: specific heat; properties of magnets; terrestrial magnetism; magnetic attraction and repulsion; frictional electricity; theories of electricity; electrical attractions and repulsions; electrical induction; electrophorus; Holtz's machine; electrical spark, nature and duration of; Leyden jar; Lichtenberg's figures, etc.

Galvani's observations; Volta's experiments; voltaic battery; constant batteries; dry piles; Oersted's fundamental experiment; tangent compass; galvanometer; Ohm's law; thermal, luminous, chemical effects; decomposition of salts; electro-metallurgy; attractions and repulsions of currents by currents; electro-magnets; chemical telegraph; induction by magnets; magneto-electrical apparatus; Ruhmkorff's coll; Gramme machine.

#### SENIOR CLASS

was occupied three hours per week during the first term in studying the subject of light: transmission, velocity and intensity of light; photo-meters; reflection of light; plane, concave, and convex mirrors; spherical aberration; refraction by plates and prisms; total reflection; dispersions by prisms; spectroscope; chemical and solar lines; lines from fixed stars; lenses, concave and convex; achromatism; camera obscura; simple and compound microscopes; astronomical and terrestrial telescopes; the eye and vision, etc.

During the second term, three hours weekly, upon the study of sound: nature of sound waves; velocity through solids, liquids and gases; reflection of sound; refraction; interference; measurement of wave-lengths; measurement of number of vibrations; vibrations of strings; musical scale; vibrations of rods, plates, and bells; organ pipes; flute pipes; reed pipes; vibrations of tuning-forks determined with chronograph; Lissajous' experiments; resonance; human voice; the ear and audition; telephone; phonograph, etc.

## ELECTIVE SENIORS

were engaged during the first term two hours per week as follows: mechanical theory of heat; determination of the mechanical equivalent of heat; conversion of heat into work; application to steam-engines; indicator diagrams; elasticity of gases; isothermals of gas and steam; adiabatics; Carnot's engine; reversible engines; caloric engines and steam engines compared; absolute temperature; kinetic theory of gases, etc.

Electrostatics; determination of the constants of a battery; measurement of resistances; Wheatstone bridge, etc.

During the second term, two hours per week as follows: absolute units; C. G. S. system; practical electrical units; theory of dynamo-electric machines; electric-lighting; arc and incandescent systems, thermodynamics of battery, etc.

Undulating theory of light; propagation of light by waves; reflection of light; refraction of light; total reflection; interference of light; Fresnel's experiments; Newton's rings explained by the undulatory theory; thin plates; thick plates explained by the undulatory theory in the same manner; double refraction in uniaxial and biaxial crystals; conical refraction; plane polarization; circular polarization; elliptical polarization; rotary polarization, etc.

Respectfully submitted,

OGDEN N. ROOD,

*Professor of Physics.*

Columbia College, May 16, 1887.

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DEPARTMENT OF HISTORY AND POLITICAL  
SCIENCE.

*To the President of Columbia College :*

The Department of History and Political Science in the School of Arts would beg to report that the usual instruction prescribed by the statutes of the Trustees has been given during the present year; Mr. Goodnow and Mr. Dunning instructing the Sophomore class in German and

French History six hours per week throughout the year ; Prof. E. M. Smith instructing the Junior class in English History two hours per week during the first semestre, and Prof. R. M. Smith the Senior class in the Constitutional History of England two hours per week throughout the year. The Senior class has also received instruction from the head of the department in the Constitutional History of Germany, France, and the United States four hours per week throughout the year.

Respectfully submitted,

J. W. BURGESS,

*Professor of History and Political Science.*

Columbia College, May 16, 1887.

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*DEPARTMENT OF PHILOSOPHY, ETHICS, AND  
PSYCHOLOGY.*

*To the President of Columbia College :*

The following courses have been given in this department during the past academic year :

I. Graduate Courses, by the Professor of Philosophy.

1. Modern Pessimism, one hour per week.
2. The Development of English Skepticism, one hour per week.
3. The Post-Kantian Philosophy, one hour per week.
4. Martineau's Ethics and Critics, one hour per week.

These were courses of lectures, the first and second being delivered during the first term, the third and fourth during the second term.

II. The Senior Courses, by the Professor of Philosophy.

1. General History of Philosophy, two hours per week.
2. History of English Ethics from Hobbes to Spencer, one hour per week during the second term.
3. Psychology, one hour per week.

These were courses of lectures. The class in Ethics attended also the fourth of the graduate courses mentioned

above, and completed Calderwood's *Handbook of Moral Philosophy*. Lectures were also given on contemporary English moralists. The course occupied two hours per week throughout the year.

In the report of Dr. Butler will be found a statement of additional work done by graduates under his direction and by the Junior class.

The contemplated resignation of Dr. Butler will be a serious loss to this department, his able and thorough work in which deserves great commendation.

Respectfully submitted,

ARCHIBALD ALEXANDER,  
*Professor of Philosophy.*

Columbia College, May 16, 1887.

## *REPORT ON THE PHILOSOPHICAL SEMINAR.*

*To Archibald Alexander, Ph.D.,*

*Professor of Philosophy, Ethics, and Psychology :*

The work of the Seminar in philosophy has been of a more advanced and original character than was the case during the first year of its existence. The excellence of the work accomplished calls for special notice. The total membership of the Seminar has been 10, with an average attendance at the semi-weekly sessions of 8. Of these 10 students, 6 held the degree of B.A. from Columbia and 4 held that degree from other institutions. Three of the students are Masters of Arts.

The specific work of the year has been the systematic study of Ethics and of Kant's *Kritik der reinen Vernunft*. Special topics and books have been assigned to particular students for investigation and report. Many of these reports have been indicative of marked philosophical ability on the part of their authors. The papers presented have been as follows :

Mr. Cohen : Green's *Prolegomena to Ethics* (three papers),  
May morality be based on any doctrine of personality?  
Darwin's doctrine of the development of the moral

sense. Bain's theory of punishment as a moral criterion.  
Criticism of the logical basis of Kant's Categories.

Mr. Harrison: Hamilton's theory of consciousness. Wallace on the development of the moral Sense.

Mr. Linehan: The identification of pleasure with the good in the *Protagoras*. Hume's Moral Essays (two papers).

Mr. Nies: The relation of ethics to psychology. Royce's Religious Aspect of Philosophy (two papers).

Mr. Grint: The methods of ethical study. Herbert Spencer's Ethical Teaching (two papers).

Mr. Earle: Janet's theory of morals. Is Kant's distinction between analytic and synthetic judgments absolute?

Mr. McCrea: Aristotle's Tricomachean Ethics. Are mathematical judgments analytic or synthetic?

Mr. Leipsiger: Principal Shairp's Ethical Writings (two papers).

Mr. R. I. B. Illman: Bain's Moral Science. Stephen's Science of Ethics.

Mr. G. F. Illman: Stewart's Moral Philosophy. Adam Smith's Theory of Moral Sentiments.

Your attention is called to the fact that the future usefulness of the Philosophical Seminar depends very largely upon arrangements being made by which students in the various professional schools in this city, theological and other, may attend its sessions and participate in its work without conflicting with their work in such schools. It would also be of inestimable advantage could two or more scholarships of \$250 each be established, to be held for one year by students selected by the Faculty on condition that they pursue a graduate course in philosophy and undertake some original investigation.

The Junior class have attended in two sections, one hour a week each, in Logic. The instruction has been given partly by text-book and partly by lecture, and has embraced Deductive Logic, Inductive and Scientific Method.

Respectfully submitted,

NICHOLAS MURRAY BUTLER,

*Tutor in Philosophy, Ethics, and Psychology.*

Columbia College, May 16, 1887.

*DEPARTMENT OF POLITICAL ECONOMY AND  
SOCIAL SCIENCE.*

*To the President of Columbia College :*

The undersigned has the honor to make the following report of the work done in this department during the past year :

The Junior class has been instructed in the general principles of political economy, two hours per week during the second term.

An elective division of the Senior class has listened to lectures on historical and practical political economy four hours per week during the entire year.

Respectfully submitted,

RICHMOND M. SMITH,

*Professor of Political Economy and  
Social Science.*

Columbia College, May 16, 1887.

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*DEPARTMENT OF THE ENGLISH LANGUAGE  
AND LITERATURE.*

*To the President of Columbia College :*

I beg leave to make the following report upon the work done, during the session of 1886-87, in the Department of English :

The Freshman class has, during both terms, been each week once with me and twice with Dr. Quackenbos. With me, it has studied the syntax and logical analysis of the language, and it has read for practice the writings of living poets and studied their style. With Dr. Quackenbos, it has studied the elements of the history of literature, and of rhetoric and composition, and it has written monthly exercises.

The Sophomore class has, during both terms, been each week once with Dr. Jackson and twice with Dr. Quackenbos. With Dr. Jackson, it has studied the historical grammar of the language, and it has read the Hamlet of Shakespeare,

with minute examination of language, thought, and plot. With Dr. Quackenbos, it has carried on the study of the history of literature, of rhetoric, and of composition, and it has written monthly exercises.

The Junior class has been each week twice with me and once with Dr. Jackson. With me, the class has studied practical rhetoric, chiefly the construction of sentence and paragraph in English prose, the philosophy of criticism and style, and the works of Bacon and Milton. With Dr. Jackson, it has studied the elements of Anglo-Saxon grammar and literature. Under my own supervision, the members of the class have written essays every two or three weeks as practice in composition.

The Senior class has been each week twice with me. It has studied the higher theory of prose-composition, the history and laws of English poetry, and the historical grammar of the language, including Anglo-Saxon. It has read with me passages of Anglo-Saxon poetry and of Chaucer's poetry, with elaborate study of language and of literary form. For practice in composition, it has, under my supervision, written every two or three weeks, essays in prose.

My class of graduates has carried on with me a regular course of work in the higher study of English prose, with elaborate investigation of the style of DeQuincey, Macaulay, and Carlyle.

The assistants in this department, Messrs. Dodge, Jackson, and Spencer, have done their work faithfully and with ever increasing skill and effectiveness. Mr. Spencer, who has aided me in the correction of the essays of the Junior and Senior classes, is about to leave the college to enter the church. I have asked to have his place filled. I enclose special reports from Drs. Quackenbos and Jackson.

Respectfully submitted,

THOMAS R. PRICE,  
*Professor of the English Language  
and Literature.*

Columbia College, May 16, 1887.

*SPECIAL REPORT ON ENGLISH LITERATURE  
AND RHETORIC.*

*To Professor Thomas R. Price :*

My report is substantially the same as that of last year, printed in the President's Annual Report. I would like to have it modified as follows :

Instruction in English literature has been given to the Sophomore class by sections. This involved an additional expenditure of time on the part of the lecturer, but insured more satisfactory results. The interest of the students in the subject has been marked, much collateral reading has been done in the library, and there has also been an unusual improvement this year in composition, the grade of essays prepared by at least fifty per cent. of the members of each class being high, both as regards original research and general style.

In response to a request made last October by a number of our students, and with the approval of the President, I formed a voluntary class, the object of which was a critical reading of Chaucer's poetry. Unfortunately, the hours conflicted with those selected by the Adjunct Professor of Greek for his extra class, so that during the second term I was obliged to discontinue this valuable exercise.

Respectfully submitted,

JOHN D. QUACKENBOS,  
*Adjunct Professor of English.*

Columbia College, May 16, 1887.

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*SPECIAL REPORT ON ENGLISH AND ANGLO-  
SAXON.*

*To Professor Thomas R. Price :*

To the sections of the Sophomore class, I have given, each week, three hours' instruction in English. During the first term they studied the historical grammar and inflections, and in addition to the regular monthly examinations



they were required to present, written out in tabular form, copies showing the changes undergone in the various inflections at the different periods of the language. During the second term the class studied the general history of the development of the English language. They also received two lectures on the prefixes and suffixes in English. In addition, throughout the year, part of each hour was devoted to reading Shakespeare's *Hamlet*, with a careful analysis of the plot and a minute examination of the language, thought, and allusions. A special study was made of some of the characters of the drama, and essays on the subject were written by each member of the class. The general interest shown in the work has been to me most gratifying.

To the Junior and Senior classes, I have given each week throughout the year, six hours' instruction in Anglo-Saxon.

The two sections of the Junior class have each attended one hour a week. The first half-year was devoted to acquiring a knowledge of the Anglo-Saxon grammar, constant drill in the paradigms being given, and special care also being taken to trace the changes in forms and inflections from the Anglo-Saxon to English. A lecture also on the general phonetic laws of the language was given. In the second half-year the translation of the texts was taken up, and selections from the *Chronicle* and from the *Gospels* were studied. The reading of the Anglo-Saxon was accompanied by comments of a grammatical, historical, and literary character, and afforded constant opportunity to apply the laws of phonetic change.

To twenty-seven Seniors who have continued their Anglo-Saxon studies with me, four hours a week have been devoted, the class being divided into sections. In Sweet's *Anglo-Saxon Reader* they have read carefully a number of selections both in prose and verse. In the readings throughout this year, in addition to the regular critical and explanatory comments, particular attention was drawn to the question of the rhetorical side of Anglo-Saxon and to the construction of the Anglo-Saxon sentence. A special review of the grammar was given during the first term,

and several lectures on the history and development of the noun and the pronoun in reference to the English verse were also given. The results of these studies were combined and written out by each student as part of the required work, in addition to the monthly examinations. In the second term, beside, they received instruction in Anglo-Saxon prose composition. The progress made has been particularly satisfactory.

Respectfully submitted,

A. V. WILLIAMS JACKSON,

*Instructor in Anglo-Saxon.*

Columbia College, May 16, 1887.

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*DEPARTMENT OF MODERN LANGUAGES AND  
FOREIGN LITERATURE.*

*To the President of Columbia College :*

The courses outlined in the Handbook have been, with unimportant alterations, pursued by the respective classes during the past year. The paucity of numbers in the third and fourth years of the French and German sections, and in the entire field of Italian and Spanish, remain still marked features of our tabulated report. These are results of the revolutions of '84-'85, and not of any lack of interest or appreciation on the part of the students, or of zeal on the part of the instructors.

With the more perfect systematization of our schemes of work, derived from larger experience and the introduction of more effective methods, we are gradually attaining a position where we can with confidence expect of the average student, at the close of the second year in French, and of the third year in German, a reasonable proficiency; such in fact, that he can consult with considerable ease works in the language pursued. This is perhaps all that we can reasonably hope to attain in the time allotted to these branches. Students, however, who abandon these or kindred

courses before attaining such a degree of proficiency, lose speedily all or nearly all that they have acquired. Such liberty of going or staying may therefore, we submit, be wisely withheld from the student, prior to the expiration of the third year in German and of the second year in French.

The division of the work in the department and the distribution of the students were as follows :

*Undergraduates.*

	Number of students.
French.....	157
German. ....	107
Spanish. ....	13
Italian .....	5
Danish and Swedish .....	1
Voluntary German.....	15
Voluntary French .....	4 to 9

*Graduates.*

Romance Department.....	1
Germanic Department.....	5

*Work of Individual Classes, Students, etc.*

*French*—FIRST YEAR (Mr. Scribner).—Two hours a week, thirty-one students. Whole of Chardenal's first French course ; exercises in translation from English ; reading, 240 pages from O'Connor's *Choix de Contes Contemporains*.

SECOND YEAR (Dr. O'Connor).—Two hours a week ; thirty-eight students. Reading, *L'Abbé Constantin* and *Le Buste*, about 370 pages. Grammatical work, whole of Chardenal's Second French Course.

THIRD YEAR (Dr. O'Connor).—Two hours a week ; fifteen students. Reading, *Le Monde où l'on s'ennuie*, *Le Testament de César Girodot*, *Le Cid*, and *Le Misanthrope*, about 410 pages. Outside reading with review in French, 600 pages. Composition, 12 essays on selected subjects.

FOURTH YEAR (Mr. Scribner).—Two hours a week ; five students. Reading, Rousseau's *Le Contrat Social*, Hugo's *Hernani*, Augier's *Le Fils de Giboyer*, and Voltaire's *L'Es-*

*sai sur les Mœurs.* Composition, exercises on idioms from Chardenal's advanced French course.

*Special Course wholly in French* (Mr. Scribner).—Two hours a week, twenty-seven students. Lectures on the 18th-century literature. Reading, nearly all of Molière's plays, La Bruyère's *Les Caractères*, and La Rochefoucauld's *Les Maximes*.

*Lectures in English* (Mr. Scribner).—Four hours a week; two courses. Origin to end of 17th century; fourteen students; 18th and 19th centuries; twenty-seven students.

*Voluntary Class* (Mr. Scribner).—One lecture a week on France; four to nine students.

The first and second years were divided into two sections.

*Spanish*—FIRST YEAR (Mr. Deghuée).—Two hours a week; ten students. Whole of Josse's Grammar. Reading, 30 pages of Mantilla's Reader and 7 chapters of *Gil Blas*.

SECOND YEAR (Mr. Clover).—Two hours a week; two students. Review of grammar, and 2 books of *Don Quixote*.

THIRD YEAR.

FOURTH YEAR (Prof. Smith).—Two lectures a week on Spanish literature; one student.

*Italian*—FIRST YEAR (Mr. Clover).—Two hours a week; four students. First part of Sauer's grammar.

SECOND YEAR (Mr. Clover).—Two hours a week; one student. Twenty-two cantos of Dante's *Inferno*.

*German*—FIRST YEAR (Dr. Carpenter).—Thirty-eight students; two hours a week. Whitney's Brief Grammar and 25 pages of Whitney's Reader. (Class divided into two sections.)

SECOND YEAR (Prof. Boyesen and Dr. Carpenter).—Two hours a week; thirty-eight students. Reading, 3 acts of Schiller's *Wilhelm Tell*. Translation from English, 40 pages of *Swiss Family Robinson*, and 30 exercises from Stahl's German Versions. Exercise in extemporaneous translation. (This class was divided into two sections, Prof. Boyesen taking three hours, Dr. Carpenter one hour per week.)

THIRD YEAR (Prof. Smith).—Three hours a week, one voluntary; twelve students. Read in class from Schiller's

*Abfall der Niederlande*, 76 pages; Wallenstein's *Tod* entire; Legging's *Laocoön*, 18 chapters; and whole of Turgenjeff's *Der Raufbold*, 58 pages. Outside of class, 500 pages. Resumé's prepared and criticised on works read, and also an essay on outside reading. Exercises in conversation.

FOURTH YEAR (Prof. Boyesen).—Two hours a week; seven students. Lessing's *Laocoön*, and Buchheim's *Deutsche Lyrik*.

*Lecture Course* (Prof. Boyesen).—Two hours a week; seven students.

*Fourth Year extra class* (Prof. Boyesen).—Three hours a week; three students. Courses of reading marked out, and men allowed to direct themselves. In class, Schiller's *Fiesco*, Goethe's *Reineke Fuchs*, and a part of the *Faust*.

*Voluntary Class* (Prof. Boyesen).—One hour a week; fifteen students. Instruction entirely in German. Conversation and composition.

*German Seminar* (Prof. Boyesen).—One hour a week; five students. Special themes. Goethe's letters and table-talk, and the character of the great mediæval preachers. Essays prepared and criticised in the presence of the class.

*Danish and Swedish* (Prof. Boyesen).—One hour a week; two students. Text-books: Hansen's *Nordiske Digtere i det 19 Aarhundrede*, Kielland's *Else*, and Jonas Lie's *Otte Fortællinger*.

### *Graduate Work.*

*Romance Department* (Dr. O'Connor).—Three hours a week; one student. Lectures on Phonology and Dialectology of Romance Languages, Elements of Wallachian, and a critical study of old French poem, *Amis et Amiles*.

*Germanic Department*.—Danish and Swedish literature. Two graduate students attended Prof. Boyesen's class.

*Icelandic* (Dr. Carpenter).—Three students; grammar and reader (Vigfusson); two hours per week.

*Goethe* (Dr. Carpenter).—Two students; *Ulfilas*, two hours per week.

*Old Saxon* (Dr. Carpenter).—Five students; Heliand, two hours per week.

A Germanic Seminar in Philology was also held in connection with the work in Old Saxon, under the charge of Dr. Carpenter.

A course of fourteen public lectures was given by the department, which was received with favor. Of these, Prof. Sprague Smith gave five on "Methods of Historical Study in Literature," and the "Early Epics." Dr. O'Connor, two on the Song of Roland. Mr. Scribner, five on French Literature; and Mr. Speranza, one on "Dante."

Respectfully submitted,

CHARLES SPRAGUE SMITH,  
*Professor of Modern Languages and  
Foreign Literature.*

Columbia College, May 16, 1887.

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## REPORT ON GEODESY AND PRACTICAL ASTRONOMY.

*To the President of Columbia College :*

I have the honor to submit the following report on the work done in Geodesy and Practical Astronomy in the School of Arts.

1. *The Second Year Post-Graduate Class* (two students) continued its work of the first year in Theoretical Astronomy by finishing Book I. of Gauss' *Theoria Motus Corporum Celestium*. The class attended me once a week up to February, 1887. The sessions were then discontinued, to be resumed in February, 1888. This action was taken to enable the students to give most of their time to the study of matters relating more especially to the subjects chosen for Ph. D. dissertations.

2. *The First Year Post-Graduate Class* (two students) has taken up the study of the mathematical theory of Prime Vertical Transits, Gauss' three-star method for time and

latitude, filar, ring and square bar micrometers, etc. Considerable practical work has been done in the Observatory. The class has attended me once a week, besides working in the Observatory.

3. *The Senior Class* (optional, two students) in Practical Astronomy attended me twice a week during the year, and also spent much time in making observations. Most of the time was given to the study of the transit instrument, the equatorial telescope, and the sextant, and to making observations with the same.

4. The Observatory has been open almost every clear evening. Students and other visitors have been shown the instruments and have had telescopic views of planets, etc., whenever work was not likely to be incommoded.

5. I am now making arrangements whereby I hope to use the Rutherford equatorial for photographic work. In this work I expect to be assisted by Dr. Laudy, of the School of Mines, whose skill and experience in photography are well known.

Respectfully submitted,

J. K. REES,

*Professor of Geodesy and Practical Astronomy.*

Columbia College, May 9, 1887.

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## DEPARTMENT OF CHEMISTRY.

*To the President of Columbia College :*

I have the honor to report that in the Academic Department of the college I have met the Sophomore class once a week during the past year, and have given instruction by lecture, with monthly examinations, on the non-metallic elements and their compounds, including the chemistry of the atmosphere and composition of water. I find the amount of time allotted to me for this purpose entirely inadequate. Between the hours taken for examination, and the

hours lost by holidays and vacations, I have on the whole a very small number of lectures. As it has always been the intention to have the Sophomore students well prepared for admission to the School of Mines, it seems desirable that they should be well grounded in the chemistry of the non-metallic elements, and I would respectfully suggest that an allotment of two hours a week would enable me to much more than double the usefulness of this course of instruction. Although the class has been very attentive and regular, it is still difficult to keep up the interest when the exercises come only once a week.

The portion of the Senior class which elected chemistry has attended two lectures a week. During the first session the subject studied was the chemistry of the metals. During the second session, organic chemistry. In addition to the lectures the members of the class have had a weekly recitation, which has been held by Dr. Wiechmann, Instructor in Chemical Philosophy and Chemical Physics. The progress made by the class has been entirely satisfactory.

There have been three graduate students attending instruction in chemistry, and their work has been very satisfactory. They have attended lectures in the School of Mines and have worked systematically in the laboratory.

Respectfully submitted,

C. F. CHANDLER,

*Professor of Chemistry.*

Columbia College, May 16, 1887.

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#### DEPARTMENT OF GEOLOGY.

*To the President of Columbia College :*

In compliance with your request I send you herewith a brief summary of what has been done in the departments of Geology, Economic Geology, and Zoölogy, during the past year.

I have delivered to the students of the School of Mines



seventy lectures in Economic Geology, seventy-nine on general Geology and Palæontology, and twenty-six on Zoölogy. I have also delivered to a portion of the Senior class of the college and to the students of the second year of the School of Architecture twenty-six lectures on Geology. In addition to this the students of the third and fourth classes in the School of Mines have had considerable laboratory practice in Microscopic Lithology and in Economic Geology under the supervision of Mr. Merrill, Mr. Porter, and myself. This comprises all that has been done in the way of oral teaching. Besides this a large amount of work has been done by my assistants in the rearrangement and relabelling of specimens in the cabinet, and by myself in the original geological investigations upon which I have been engaged for some years. These latter have been for the most part studies of ores and ore deposits, the genesis of the carbon minerals, physical and stratigraphic geology, and, in palæontology, the fossil fishes and fossil plants of the United States. On these subjects I have published during the past year papers on *Earthquakes*, *The Ice Period*, *The Origin of Graphite*, *Our Cretaceous Flora*, and others, in the School of Mines Quarterly, the Bulletin of the Torrey Botanical Club, or the Transactions of the New York Academy of Sciences; all of which are organizations for scientific research or publication, centred at Columbia College.

I have also, during the past year, finished monographs *On the Fossil Plants and Fishes of the Trias of New Jersey and the Connecticut Valley*, *On the Flora of the Amboy Clays of New Jersey*, and *On the Palæozoic Fishes of North America*. These will be published by the United States Geological Survey, and will consist of several hundred pages of text and about two hundred quarto plates. The types of the descriptions contained in these memoirs, many hundreds in number, are now in the geographical cabinet of the School of Mines, where they are safe from fire, and open for reference or study.

The additions to the cabinet made during the last year

are very numerous and valuable ; they include several hundred specimens of ores, rocks, fossils, and shells, donated by graduates of the School of Mines ; a large collection of building stones, cements, etc., given by General C. P. Stone ; a most valuable collection of skulls and skeletons, taken from the mounds of Michigan by Mr. Henry Gilman, and purchased and presented to the museum by the Hon. Hamilton Fish ; also a skeleton of *Mosasaurus*, from the Cretaceous rocks of Kansas, and a series of new and remarkable remains of gigantic fishes from the Devonian and Carboniferous rocks of Ohio and Illinois, numbering several hundred specimens, purchased and deposited in the cabinet by myself.

I may here say that the geological cabinet, now containing over one hundred thousand specimens, exceeds in volume and interest any similar collection in this country, and is one of the most attractive and instructive features in all our educational machinery. I have, however, still to deplore that, located as it is in the upper story of a high building, it is beyond the reach of many of those who would visit it if the elevator provided for it in the construction of the building were put in operation.

The Geological Department has, during the last year, suffered serious loss in the death of Mr. E. L. Petersen, our excellent curator, who died in December, 1886. Our present force consists, besides myself, of Dr. Britton, nominally my assistant, but who, having been made Instructor in Botany, and placed in charge of the Herbarium and Botanical Library, is fully occupied in this work ; also two Fellows in Science, Mr. F. J. H. Merrill and Mr. H. H. Porter, who were appointed by the Trustees at the beginning of the present academical year ; and Mr. J. I. Northrop, appointed Honorary Fellow by yourself ; all of whom have rendered me most valuable assistance.

In conclusion, I have to repeat the regret which I have before expressed to you, that the annual appropriation of \$500 made by the Trustees for the current expenses of the departments of Geology, Economic Geology, and Zoölogy has in the last year proved inadequate to meet the expen-

ditures demanded by the best interests of the college, and, as last year, I have felt compelled to expend an equal sum from my own resources. For eighteen years, when the wants of my department were certainly no greater than now, the fund annually appropriated for my use was \$1,000. It is also true that the annual appropriations for the other departments in the School of Mines, after being temporarily reduced, have been restored to their original amounts, and now each of my colleagues receives at least double the amount allotted to me. This discrimination seems to me unwise and undeserved, and I beg you will use your influence to have the injustice corrected.

Yours very truly,

J. S. NEWBERRY,  
*Professor of Geology.*

Columbia College, May 16, 1887.

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*REPORT ON THE SUB-DEPARTMENT OF  
BOTANY.*

*To Professor J. S. Newberry :*

I have the honor to make the following report on the sub-department of Botany.

Instruction in the several departments of Botany has been given by me during the past year as follows :

To an elective and optional section of the Junior class in the School of Arts, numbering eighteen students, in lectures one hour per week ; to an elective section of the Senior class in the School of Arts, numbering nine students, in laboratory work in histology and organography, one hour per week, though from the interference of other elective studies I have had to spend three hours per week, the students coming at different times ; to the second-year class in the School of Mines, with the exception of the students in the Course of Architecture, lectures one hour per week ; and to Mr. John I. Northrop, post-graduate

student and Fellow in Science, whose original investigations on the vegetative organs of the Wax Plant (*Hoya carnosa*) I shall soon be able to submit as a portion of his course of study for the degree of Doctor of Philosophy. I have also lectured to the students in the School of Library Economy on the subject of Botanical Bibliography, and furnished information on botanical matters to students and graduates whenever it has been asked.

All the remainder of my time has been devoted to the Herbarium. The labor of transferring the mounted botanical specimens from the old building to the cases in the new Herbarium Room in the Library Building has been concluded, and the work of rearranging the collections conformably to modern systems of classification has made satisfactory progress. Several thousand specimens of the Meisner Herbarium have been mounted, named, and properly distributed, and many others, obtained by gift, exchange, or purchase, have been added to the collections. Among the most valuable of the latter are two sets from the Mexican States of Sonora and Chihuahua, one collected by Drs. C. C. Parry and Edward Palmer, and presented to us by Wm. M. Canby, Esq., of Wilmington, Del., the other obtained by purchase from Dr. Palmer; a large collection containing many species not before represented in our Herbarium, from Texas, Arizona, California, and Northern Mexico, by purchase from Mr. C. C. Pringle; and some three thousand specimens collected by Dr. H. H. Rusby in various parts of South America, among them many species unknown to science and others of great economic importance. Dr. Rusby and myself are now engaged in elaborating this last-named collection.

In order to bring the resources of the Herbarium and the Library to the attention of the public, and to endeavor to add something to the fund of botanical knowledge, I have begun a series of original papers under the title "Contributions from the Herbarium of Columbia College." Two of these have been issued during the year—one entitled "A Preliminary List of North American Cyperi," written by

myself; the other, "On *Cerastium arvense*, L., and its North American Varieties," in the preparation of which I was aided by Mr. Arthur Hollick, Ph.B., Class of 1879. These have been favorably received, and others are in preparation.

The course in Botany in the School of Arts is now so planned that students have the opportunity of attending a series of lectures on Vegetable Anatomy and Physiology, Morphology, and Classification in the Junior year, followed in the Senior by practical study with the aid of the microscope and reference to the Herbarium. But it is not stipulated that, in order to take advantage of the advanced work of the Senior year, students must have attended the Junior lectures or, at least, have passed an examination equivalent to those required during the Junior terms. This has caused some embarrassment, as I have not considered it just to refuse Senior students for this reason. Were it understood, however, that this restriction was placed on the course, I have no doubt that the work accomplished would be of a somewhat higher order, and respectfully recommend that such restriction be made. Students who desire to elect Botany during only one year should do so in the Junior.

The time now allotted to the elective courses in Botany—one hour per week during the Junior and Senior years—is insufficient for the exhaustive treatment of the subject. The need of additional hours is most marked in the Junior year, where it has to be taught in the most elementary manner. I would respectfully recommend that this elective be increased to two hours per week.

The course in the School of Mines has, as usual, been mainly directed towards preparing the students for the lectures on Geology and Palæontology in the third year, and the time given—one hour per week—is sufficient for this purpose.

Respectfully submitted,

N. L. BRITTON,

*Instructor in Botany.*

Columbia College, May 16, 1887.

*REPORT ON SANSKRIT.**To the President of Columbia College :*

I have the honor to make the following report upon the instruction in Sanskrit, given by me during the college year 1886-87, now drawing to a close.

I have conducted an elementary course in Sanskrit, attended by two members of the Senior class, of three hours per week throughout both terms. The class has gone through my "Sanskrit Primer," and has read the classical portions of Lanman's "Sanskrit Reader," *i. e.*, 68 pages. The interest displayed and the careful thoroughness with which the work has been done are most creditable to the members of the class, Messrs. Gasten and Knapp; and the amount accomplished is believed to be greater by not a little than that commonly done in the first year of instruction.

It was my intention to conduct also a class for advanced Vedic Sanskrit, for which several graduates had offered themselves; but with my ten hours of Greek classes my weekly hours amounted to thirteen, and I thought it prudent to limit, for this year, my hours of instruction to that number.

Respectfully submitted,

EDWARD DELAVAN PERRY,  
*Instructor in Sanskrit.*

Columbia College, May 16, 1887.

*REPORT ON INSTRUCTION IN THE SEMITIC LANGUAGES.**To the President of Columbia College :*

I have the honor to present the following report of the instruction given in Semitic during the present college year :

**I.—BIBLICAL HEBREW.**

Seven members of the Senior class attended the undersigned throughout the year in Biblical Hebrew,—four of them making it a part of their regular course. During that

time they received instruction in the grammar, including both a careful study of the forms and also of the syntax, and read selections from Genesis. In the second term several of the shorter psalms were selected for more rapid reading, to give the class facility in translation. Lectures were also given from time to time on Hebrew literature, and the general inter-relation of the Semitic languages. In the Graduate Department two candidates for the Master's degree read the following, with careful attention to the exegesis, these gentlemen being already sufficiently well versed in Hebrew to read ordinary prose at sight: Selections from Deuteronomy, Leviticus, Isaiah, Nahum, Jonah, and the Psalms.

## II.—SYRIAC.

Two courses in Syriac were offered by Dr. R. J. H. Gottheil, open to members of the Senior class and to Graduates. Two hours per week were given in each course. The principles of the grammar were carefully studied, combined with the reading of easy passages from the Syriac New Testament.

One graduate attended the higher course. He has read with Dr. Gottheil "The Book of the Laws of Countries" of the Gnostic Bardesanes, edited by Cureton in his *Spicilegium Syriacum*. Special attention was given to the relation of this treatise to the Greek "Dialogue of Bardesanes on Fate," mentioned by Eusebius and others.

The lectures on Syriac literature, though announced, were not delivered, as the term was somewhat advanced when the instruction commenced.

## III.—ARABIC.

Two members of the Graduate Department attended the undersigned twice a week in Arabic. After a very careful study of the grammar (Prof. Wright's being taken as the standard), the Book of Jonah, in the Arabic version, edited by Wright, was read critically, after which some ten Surahs of the Qu'ran were studied with explanatory lectures on

the subject-matter and a thorough investigation of many matters of collateral interest.

IV.—COMPARATIVE SEMITIC GRAMMAR.

At the especial request of several of the students in this department, the undersigned delivered a course of lectures upon the general subject of Semitic Grammar, with particular attention to the points of resemblance and contrast existing between Semitic and Indo-European. The theories of the three great schools of German Semitic Philology were carefully considered and set forth, especial notice being taken of the views of Meier, Ewald, and the younger Delitsch. These lectures were attended by some twenty persons interested in philological studies, although no public announcement of the course had been made.

Respectfully submitted,

H. T. PECK,

*Instructor in the Semitic Languages.*

Columbia College, May 16, 1887.

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REPORT ON INSTRUCTION IN THE OLD IRANIAN LANGUAGES.

*To the President of Columbia College :*

During the year, five hours in general each week have been devoted to instruction in the Old Iranian Languages, as follows :

1. *Avestan*.—First year. Two hours a week. This study has been taken as an optional by one member of the Senior class. The text-book used has been Geiger's *Handbuch der Avestasprache*. After acquiring a knowledge of the grammar, the following selections from the Avesta, Yasna IX., X., Yasht VI., VIII., Vendidad II., VI., were carefully studied, references to the Sanskrit supplementing the work at each step. Special stress was also laid on the metrical reconstruction of the text wherever possible.



2. *Avestan*.—Second year. One hour a week. This was taken by one post-graduate who has been continuing his Avestan studies. The course provided for a more extended study of the Avesta, chiefly according to the "comparative" method, not neglecting, however, the interpretations of the so-called "Traditional school." Attention was turned in particular to the Gāthā portion of the literature.

3. *Old Persian Cuneiform Inscriptions*.—Two hours a week. This course was taken in connection with the latter. A critical study was made of several of the Behistan and Persepolis inscriptions, and selections from some of the other inscriptions were read. Particular attention was given to practice in reading the cuneiform characters.

The interest shown by both the students in this department was very gratifying. Instruction in Pehlevi also will in the future be offered, and it is proposed to make preparations besides for work in the Modern Iranian languages, as well perhaps as in Armenian.

Respectfully submitted,

A. V. WILLIAMS JACKSON,

*Instructor in Zend.*

Columbia College, May 16, 1887.

*SCHOOL OF MINES.*

**APPENDIX B.**

**SCHOOL OF MINES.**

**REPORT ON THE GENERAL STATE OF THE SCHOOL BY THE  
DEAN OF THE FACULTY.**

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*To the President of Columbia College :*

I have the honor to report that the twenty-third annual session of the School of Mines, now about to close, has been in every respect satisfactory.

On last Commencement day thirty-two diplomas were issued to graduates of the School of Mines, as follows :

In Mining Engineering (E.M.).....	15
Civil Engineering (C.E.).....	8
Analytical and Applied Chemistry (Ph.B.).....	4
Architecture (Ph.B.).....	5
	<hr/>
	32

In addition to the foregoing diplomas official mention was made at Commencement of one diploma in Civil Engineering which had been granted during the year.

Since last Commencement the following degrees have been awarded to members of the class of 1886, who had not previously complied with all the requirements.

In Mining Engineering.....	1
Civil Engineering.....	1
	<hr/>
	2

Also, since last Commencement, the degree of Doctor of Philosophy was awarded to a graduate of the School.

During the past year two hundred and eighty-seven (287) students have been in attendance on the exercises of the School of Mines, distributed as follows :

First Class.....	87
Second " .....	72
Third " .....	52
Fourth " .....	53
Resident Graduates.....	17
Graduate Students, School of Arts.....	6
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Total.....	287

These students have pursued the different parallel courses of the School as follows :

	First Class.	Second Class.	Third Class.	Fourth Class.	Res. Grad.	Grad. S. of A.	Total.
Mining Eng.....	17	22	6	22	—	—	67
Civil Eng.....	31	26	19	12	1	—	89
Metallurgy .....	2	1	1	2	—	—	6
Geology .....	—	—	3	—	—	—	3
Anal. and App. Chem.	20	9	14	13	—	—	56
Architecture .....	17	14	9	4	1	—	45
Sanitary Eng.....	—	—	—	—	2	—	2
Doctor of Phil.....	—	—	—	—	12	—	12
Miscellaneous .....	—	—	—	—	1	6	7
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	87	72	52	53	17	6	287

The graduating class numbers 51,\* distributed among the parallel courses as follows :

In Mining Engineering.....	22
Civil Engineering.....	12
Metallurgy.....	2
Analytical and Applied Chemistry .....	11
Architecture .....	4
<hr/>	
	51

\* Original number 53 ; one member died during the year, and one left.

It is impossible to say at this time how large a proportion of the class will be able to graduate at Commencement, as the final examinations have not yet been held.

The cabinets of the School have continued to receive additions by purchase and gift, mineralogical, metallurgical, and chemical specimens, rocks, fossils, and models.

Respectfully submitted,

C. F. CHANDLER,

*Dean of the Faculty.*

Columbia College, May 17, 1887.

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*DEPARTMENT OF MINERALOGY AND  
METALLURGY.*

*To the President of Columbia College :*

According to your request, I send you a record of the work done in my departments this year, which has been unusually heavy. In the Department of Metallurgy the lectures have been sadly interfered with by the vacations and holidays, which have come so frequently this year as to make the delivering of the lectures extremely difficult, more so than ever before. They have, however, been delivered and the ground covered almost as usual, although the lectures have been necessarily very much condensed. The only interruption to the course was during the month of November, when I was confined to the house for two weeks with an attack of bronchitis. The whole of the metallurgical collection has been arranged and is now ready for study and inspection, and is in good shape. It was seriously injured by being packed as it was for so many years, but I have elicited some interest on the part of manufacturers, and have already had promises of some additions to it. It is, so far as I know, the finest metallurgical collection in the United States, and if it only had the proper space could be made as fine as any in the world, but I suppose this space can hardly be had until a new building is erected. It is very desirable that a new building should be

erected, as all the departments of my work are very much crowded. The constant demands on the time of the students have made instruction in both my departments extremely difficult this year, and if the time is to be so taken up it will be absolutely indispensable for the students that there should be another assistant allotted to these two departments. As it now stands, the demands on all sides for instruction are such that the force is not sufficient to do the work. Both my assistants have done their best, always remaining at the School until a late hour in order to do the work, but notwithstanding that, there is not sufficient force to give the instruction which the students ought to have, and it will be impossible to do it if the changes proposed by the Committee on Reorganization of the School are carried into effect. Another assistant would make it possible to give the students all the instruction proposed and necessary, and would greatly benefit the School and relieve the students.

It would greatly aid the work of the metallurgical department if a small sum could be annually voted for the distribution of blue prints amongst the students. I have spent three years in getting up the photographs for these blue prints, and begged for them nearly the whole amount which they cost. As soon as finished, copies of these were asked for by the schools of mines in England, France, Germany, and Brazil. Copies were furnished them, but I find that the students, although wanting them, do not, as a general thing, feel able to purchase them, and I have not been able to find any publisher who would take hold of the matter. I do not make this as a recommendation, however, but as a suggestion as to how the efficiency of the department might be increased.

It has been found necessary on account of the new methods of instruction to break up the lecture collection, illustrating the subject of metallurgy, and to interpolate it in the new collection used for personal instruction in mineralogy. This last collection contains about 2,500 specimens, and its formation, though it has been a great labor, will be of great advantage to the students. In the Department of

Mineralogy the collection of large specimens has been entirely rearranged and relabelled and catalogued, greatly to the benefit of the collection. The new system of labelling, which I adopted after much thought, not only increases the space but makes the display much more instructive, and at the same time more beautiful. Besides this, the collection of Pseudomorphs has been entirely rearranged and enlarged, as has also been the collection of artificial minerals. We have commenced a collection to illustrate the forms of crystals from natural minerals, which we hope to have completed during the next year. If I undertake the making of a collection for one of the western universities, which has been suggested to me, I shall be able to do a great deal for our own collection at the same time, as I shall have a large sum put at my disposal for purchasing minerals for them in Europe, which will enable me to make changes and exchanges for minerals which the department now has. In the Department of Mineralogy we are also very much crowded, and I had hoped to have been able to use the empty elevator shaft as a closet for drawers. I learn with regret, however, from Mr. Porter, that the elevator is likely to be put in. Some changes and advances have been made in the system of instructing in both mineralogy and blow-piping, greatly to the interest of the students and the efficiency of the course. I had supposed that these departments had been brought up to their greatest efficiency with the force which I now have at my command, but the demands upon the students' time have been such that I have been obliged to partially reorganize it, and if another assistant is allowed the new methods will greatly increase its efficiency. This department is very greatly admired by all persons who visit it, especially foreigners, who have been in the habit of seeing instruction given on this subject by the German methods.

I greatly regret to say that on account of want of money I have been obliged to decline to purchase several beautiful collections of American minerals, which have gone immediately from the School of Mines to Europe.

The number of specimens added to the mineralogical collection during the year has been 880, and their value is about \$603.75. The number of specimens added to the metallurgical collection I have already reported to you. Now that this collection is displayed, I hope to interest manufacturers in presenting specimens to it.

Yours respectfully,

THOMAS EGLESTON,  
*Professor of Mineralogy and Metallurgy.*

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### DEPARTMENT OF CHEMISTRY.

*To the President of Columbia College :*

I have the honor to report that in the Chemical Department of the School of Mines during the first term of the past year I met all the First-Year students twice a week and lectured upon the metals. Mr. Lederle, Honorary Fellow in Quantitative Analysis, has held recitations upon the lectures, the class being divided into four sections for this purpose, each section reciting once a week. During the second term I have met the First-Year students, in the course of Analytical and Applied Chemistry, twice a week, lecturing upon Organic Chemistry ; and Mr. Pellew, Honorary Fellow in Bacteriology, has held recitations upon the lectures. In addition to this the First-Year students in the course of Analytical and Applied Chemistry received instruction in Chemical Physics twice a week, during the second term, from Dr. Wiechmann, Instructor in Chemical Physics and Chemical Philosophy.

I met the Second-Year students in all the courses twice a week, during the first term, and lectured upon the chemistry of the metals. The class was divided into four sections, and each section attended recitations once a week under the direction of Mr. Howe, Honorary Fellow in Assaying. During the second session the instruction was devoted to Organic Chemistry and was limited to the students in the course of Analytical and Applied Chemistry, and the recitations were held by Mr. Moldenke, Honorary

Fellow in Qualitative Analysis. The Second-Year students, in the course of Analytical and Applied Chemistry, have also attended four recitations a week throughout the year on the subject of Chemical Philosophy under the instruction of Dr. Wiechmann.

All the students of the Third Class have attended my lectures twice a week on Applied Chemistry, and they have also attended in sections weekly recitations on the subject of the lectures held by Dr. Laudy.

I have met the Fourth-Year students, in the course of Analytical and Applied Chemistry, twice a week for instruction in Applied Chemistry, and recitations have been held by Dr. Laudy.

In Qualitative Analysis Dr. Wells has given to the First-Year students two lectures a week, and Dr. Vulté has held recitations four times a week upon the subject, the class being divided into two sections.

Mr. Bowen has met the students of the Second Year, in the courses of Metallurgy and Analytical and Applied Chemistry, for lecture and recitation on Qualitative Analysis, three times a week during the entire year; and he has met the students of the third class, in the same courses, twice a week during the entire year. During the last half of the second session he met an elective session of the Fourth-Year students, in the course of Mining Engineering, three or four times a week for instruction in Quantitative Analysis.

During the first session Prof. Ricketts lectured twice a week on Assaying to the Third-Year Mining Engineers and Geologists, and the Assistant Instructor, Mr. Lacombe, held two recitations a week on the same subject, dividing the class into sections. Prof. Ricketts also gave instruction in the theory and practice of Ore-Testing to the Fourth-Year Mining Engineers, Metallurgists, and Geologists. Mr. Lacombe held recitations once a week on the same subject.

The students in the course of Analytical and Applied Chemistry, in the Fourth Year, have had special instruction from Mr. Colby, Instructor in Organic Chemistry. He has



lectured to them four times a week throughout the entire year, and they have also devoted a large part of their time to the practical study of organic chemistry in the laboratory. Work in the organic laboratory has been greatly facilitated by the improvements in the apparatus and fixtures that were made during the past summer, and a decided advance has been made in the completeness of the instruction in this course. Great interest has been manifested by the students, and the first step in the direction of original investigations has been taken, Mr. Colby, with the assistance of one of his students, having published an important investigation in the *Berichte* of the Berlin Chemical Society, which was reprinted in several other scientific journals.

In addition to the above instruction in the lecture and recitation room, the students have practised the various branches of chemical analysis, etc., as follows:

The First-Year students—Qualitative Analysis, under Dr. Wells and Dr. Vulté.

The Second- and Third-Year students — Quantitative Analysis, under Mr. Bowen, assisted by Mr. Lederle.

The Third-Year students—Assaying, under Prof. Ricketts and Mr. Lacombe.

The Fourth-Year students—Organic Analysis and Investigation, under Mr. Colby.

I submit herewith the accompanying reports from Prof. Waller on the work in Quantitative Analysis; from Prof. Ricketts on the work in Assaying; from Dr. Wells on the work in Qualitative Analysis; from Mr. Colby on the instruction in Organic Chemistry; and from Dr. Wiechmann on the instruction in Chemical Physics and Chemical Philosophy.

The general attendance and progress of the students have been very satisfactory.

Respectfully submitted,

C. F. CHANDLER,

*Professor of Chemistry.*

Columbia College, May 17, 1887.

## SPECIAL REPORT ON QUANTITATIVE ANALYSIS.

*To Professor C. F. Chandler :*

I have the honor to report the following details regarding the work in my division of Analytical Chemistry (Quantitative Analysis) during the past college year.

*Lectures* have been delivered as follows :

To Second-Year students in Chemistry—three times a week throughout the year.

To Third-Year students in Chemistry—twice a week throughout the year.

To Fourth-Year students in Mining Engineering—sometimes three, sometimes four times a week from March 1st until the close of the year. They were delivered usually after 2 P.M., and at such times as were found not to interfere seriously with other duties in the laboratory.

*Recitations* have also been held for the Second and Third Year students in Chemistry, thrice and twice a week respectively, (corresponding in frequency with the lectures).

For the Fourth-Year students in Mining Engineering recitations have been held whenever it was deemed advisable.

*Examinations* have been held monthly of the Second and Third-Year students in Chemistry, and also at the end of each term. Each set of students working in the laboratory during that term have been separately examined on the work of the term.

*Laboratory work* has been conducted eight hours daily during five days of every week of the session.

The Second-Year students in Chemistry have been occupied with the examination of twenty-five different substances (representing upwards of sixty close determinations). The list of substances has been previously given. The first six of these substances are pure salts, the percentage composition of which is known to the student. The other nineteen are minerals, alloys, furnace-products, etc.

The Third-Year students in Chemistry have been occupied with the examination of twenty-nine different substances (representing some seventy-five or eighty determina-

tions). Eleven of the substances (the work of the first term) are ores, alloys, etc., giving practice in mineral analysis; the remainder (the work of the second term) affording practice chiefly in proximate analysis, and in the most important determinations connected with industrial chemistry.

The Fourth-Year students in Mining Engineering have been engaged more especially in the study and practice of some of the most important rapid methods of analysis in use in metallurgical laboratories. The list of substances is essentially the same as that already given.

*Attendance.*—The number of students attending these exercises has been as follows:

	Lectures & Recitations.	Lab. Work.
Second Year—Chemical Course.....	7	10
Third “ “ “ .....	12	12
Fourth “ Metallurgical “ .....		1
“ “ Mining Eng. Course.....	10	11
Total.....	29	34

The zeal and application of the students as a whole have been commendable. It has, however, been most marked among the older students, especially in the case of the Fourth-Year students in Mining Engineering.

During my absence (on account of domestic affliction) the duties of the lecture-room and laboratory have devolved upon my chief assistant, Mr. H. C. Bowen, who has performed them with conscientious ability.

The past year has been the first in which an honorary assistant (appointed from the graduating class) has served in the Quantitative Laboratory, and the plan has been found advantageous to both sides. Mr. E. J. Lederle, the honorary assistant, has performed his share of the work most carefully and satisfactorily.

Respectfully submitted,

ELWYN WALLER, Ph. D.,

*Professor of Analytical Chemistry.*

Columbia College, May 17, 1887.

*SPECIAL REPORT ON ASSAYING.*

*To Professor C. F. Chandler :*

I have the honor to submit the following report on the instruction given in the Assay Department, and the improvements made in the condition of this department during the school year 1886-87.

During the first term of the present school year I delivered two lectures per week on Assaying to the third-year mining engineers and geologists. The assistant instructor, Mr. C. F. Lacombe, held two recitations per week on the subject, dividing the class in sections in order to secure better work.

The practical work in the laboratory was conducted with the aid of Mr. Lacombe, and that of the Honorary Fellow in Assaying, Mr. Epenetus Howe.

During the second term I was not called upon to lecture, owing to the fact that the Assaying had been changed from the second to the third year, and the chemists and metallurgists in the present third-year class had already taken the course. For the same reason the recitations were omitted.

The instruction in the laboratory and ore-testing works has been conducted with the aid of Mr. C. F. Lacombe, who has proved himself a most efficient instructor.

The total number of students attending the lectures and laboratory instruction in Assaying during the year is as follows: Mining engineers, 9; geologists, 3; metallurgists, 2; chemists, 1.

In addition to these I have given instruction in the theory and practice of ore-testing to the fourth-year mining engineers, metallurgists, and geologists, the assistant instructor holding one recitation per week on the subject.

The average standing of the students has been very satisfactory.

The additions and changes in the furnace-room have proved exceedingly satisfactory. The rearrangement of

the crucible furnace, by which the piping overhead was done away with, has resulted in increased comfort, and has enabled the students to do much better work than ever before. New furnaces have also been added.

In the ore-testing works some changes have been made to facilitate and systematize work, but no additional machinery has been added, although a donation of a new pulverizer has been promised by one of our graduates.

Very respectfully yours,

P. DE P. RICKETTS,

*Professor of Assaying.*

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### *SPECIAL REPORT ON QUALITATIVE ANALYSIS.*

*To Prof. C. F. Chandler :*

I have the honor to submit the following report of the work done in the Qualitative Laboratory for the year ending May 14, 1887. During the year the laboratory has been open on Mondays, Tuesdays, Thursdays, and Fridays, from 2 to 5 P.M., and on Saturdays from 9 A.M. to 2 P.M. The class, comprising twenty chemists, eighteen mining engineers, and one metallurgist, has been divided into two sections, each working in the laboratory and drawing-room on alternate weeks. On Saturdays, and on other days after the close of the drawing-room at 4 P.M., both divisions have been present in the laboratory. The attendance has been prompt and regular, and with few exceptions much interest has been shown by the students in their work.

The theory of qualitative analysis has been taught, as usual, by lectures, two of which have been given every week, and on the subject of these lectures, the class, divided into two divisions, has recited to my assistant, Dr. Vulté, who has met each division twice a week for that purpose.

The plan adopted in 1885-86 of allotting each student

only a certain quantity of chemicals, such amount, however, being ample for his work, has been continued during the past year, and with equally satisfactory results, the saving in material being very great.

Respectfully submitted,

JAMES S. C. WELLS,

*Instructor in Qual. Anal.*

Columbia College, May 16, 1887.

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### *SPECIAL REPORT ON ORGANIC CHEMISTRY.*

*To Professor C. F. Chandler :*

I have the honor to submit the following report of the work done in the Organic Laboratory during the college year 1886-87.

My instruction has been confined to those students of the Fourth class, who were pursuing the course in Analytical and Applied Chemistry.

*Lectures.*—The students attended lectures on Organic Chemistry four hours per week throughout the year. There were no recitations, but monthly written examinations were given instead. The subject was discussed in the same order as last year. Owing to the fact that more time was allotted to this branch, in comparison with last year, the subject was more thoroughly treated. The object of the lectures was the exposition of the principles involved in the laboratory work.

*Laboratory Work.*—During the first part of the first term, each student made accurate elementary analyses of organic bodies, estimating by combustion, carbon, hydrogen, and nitrogen; determining vapor densities, and calculating formulæ.

The work of the student for the remainder of the year was devoted to the synthetical preparation of a certain number of organic compounds and investigating the same. He thus applied experimentally the reactions taught in the lectures. Each student prepared an average of twenty-four

such substances during the year. These preparations have been added to the collection in the Chemical Museum. The students also made a number of artificial dyestuffs and applied them to wool, cotton, and silk. They also had individual practice with the calico printing machine.

The laboratory was open five days in the week, from 9 A.M. to 5.30 P.M.

The attendance in the laboratory averaged thirty hours per week to each student. The following table shows the time devoted to Organic Chemistry by my class during the year.

	Lectures.	Laboratory.
First term .....	52 hours.	450 hours.
Second term.....	42 "	360 "
	<hr/> 94	<hr/> 810

Each student received my individual assistance during the hours devoted to laboratory work.

Respectfully submitted,

CHARLES E. COLBY,

*Instructor in Organic Chemistry.*

Columbia College, May 16, 1887.

### *SPECIAL REPORT ON CHEMICAL PHYSICS AND CHEMICAL PHILOSOPHY.*

*To Professor C. F. Chandler :*

I have the honor of submitting to you the following report for 1886-87.

The First-Year students, in the course of Analytical and Applied Chemistry, received instruction in Chemical Physics twice a week during the second term. The lectures given treated of: Matter, Motion, Force, Gravitation, Work, and Energy; the Solid, the Liquid, and the Gaseous states of Water; the Properties of Matter in these states; Specific Gravity; and Weighing and Measuring. The recitations

held were on the subject-matter of these lectures, and on lessons assigned in Cook's *Principles of Chemical Physics*, the text-book used. Whenever feasible, problems illustrating the principles taught were worked in class.

The Second-Year students, in the course of Analytical and Applied Chemistry, were met four times a week throughout the year. They received instruction in Chemical Philosophy. The work done embraced lectures, recitations, and the demonstration of numerous problems, involving all the principles of Stoichiometry. The text-book used was Cook's *Principles of Chemical Philosophy*.

In addition to the regular work of the course, the class read a considerable part of Pattison Muir's *Treatise on the Principles of Chemistry*, an advanced and valuable work on Chemical Philosophy.

The Senior students of the School of Arts who had chosen Chemistry as an elective were met once a week throughout the year for a discussion of and questioning on the lectures delivered by the Professor of Chemistry. The matter reviewed was, during the first term, The Chemistry of the Metals; and during the second term, Organic Chemistry.

Respectfully submitted,

F. G. WIECHMANN, Ph. D.,  
*Instructor.*

Columbia College, May 16, 1887.

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### DEPARTMENT OF MECHANICS.

*To the President of Columbia College :*

The following is a brief account of the work done in this department during the past year in the School of Mines.

Thirty-nine members of the *third class* of the School of Mines enrolled their names in this department. As has been the custom for several years the class was divided into two sections, the first of which has attended me twice a week throughout the year, and the second has attended Prof. Rees. The division into sections is only for the pur-



pose of recitation and drill; the whole class has attended me when lectures have been given. These lectures have had for their object a more extended course than that given in the text; they have embraced the application of the Calculus to the determination of the centre of gravity, the laws of friction, the determination of the moment of inertia, together with many other applications of the Calculus.

The limited time allotted to this subject has forced the omission of much that would be useful to the student of engineering.

*Assistance.*—Mr. Lincoln Cromwell, a fellow in science, has been assigned to my department, and has aided me in reading the numerous examination papers now required by our rules. He has aided me in the exhibition of the lantern illustrations, and in preparing the experiments shown to the classes in mechanics. In addition to these duties he has manifested much ability and zeal.

Respectfully submitted,

WM. G. PECK,  
*Professor of Mechanics.*

Columbia College, May 16, 1887.

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#### DEPARTMENT OF MATHEMATICS.

*To the President of Columbia College :*

I have the honor to report that, during the past year, the First and Second classes have attended in mathematics as follows :

The First class, three times in sections, and once as a class—in all four times per week.

The Second class, once in sections, and three times as a class—in all four times per week ;

and have completed the course of study as set forth in the Handbook of Information for the year. The more proficient students in the two classes have, as usual, accomplished

considerable work outside and in advance of the prescribed curriculum.

The Fellows of the School of Arts, assigned to the department, have continued their efficient assistance, with the like beneficial results, of which mention was made in my report of last year.

One of the resident graduates has attended me two hours weekly throughout the year, for the further study of the differential and integral calculus.

Respectfully submitted,

J. H. VAN AMRINGE,  
*Professor of Mathematics.*

Columbia College, May 16, 1887.

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### DEPARTMENT OF PHYSICS.

*To the President of Columbia College :*

The following is a statement of the work done in the Physical Department in the School of Mines during the year.

*Third-Year class*, School of Mines, was occupied two hours per week during the first and second terms, on the same subjects as the Elective Seniors.

*First-Year class*, School of Mines, was occupied three hours during the first, and three hours during the second term, as follows :

Expansion of solids, liquids, and gases ; mercurial and air thermometers ; maximum and minimum thermometers ; density of gases, vapors and tension of ; evaporation ; ice-machines ; hygrometry ; conduction of heat by solids, liquids, and gases ; radiant heat ; latent heat of liquids and gases ; high and low-pressure steam-engines.

Magnetism ; magnetic induction ; terrestrial magnetism ; magnetic attractions and repulsions.

Frictional electricity ; induction ; electrical attractions and repulsions ; Holtz's machine ; electroscope ; electro-

phorus ; spark, nature, and duration of ; Leyden jar ; Franklin's plate ; discharger ; electrometers ; mechanical, chemical, calorific, and magnetic effects of the discharge.

Galvani's observations ; Volta's experiments ; constant batteries ; Oersted's experiment ; properties of the electric light ; electrometallurgy and decomposition of salts ; magnetizations by currents ; telegraph ; induction by magnets ; Gramme machine ; Ruhmkorff's coil ; induction ; diamagnetism ; thermo-electricity.

Optics ; velocity and intensity of light ; photometers ; reflection ; mirrors, plane, concave, and convex ; refraction by plates, prisms, and lenses ; spectra ; spectroscope ; chemical lines ; fluorescence ; achromatism ; simple and compound microscopes ; telescopes ; camera obscura ; solar microscope ; photography ; eye and vision.

Acoustics ; propagation and velocity of sound in solids, liquids, and gases ; reflection and refraction of sound waves ; measurement of the number of vibrations ; chronograph ; tuning-fork ; synthesis of sounds ; interference ; vibrations of strings ; organ pipes ; flute pipes ; reed pipes ; vibrations of rods, plates, and bells ; Lissajous' experiments ; phonograph ; telephone, etc.

Many problems relating to the above were solved by the different classes.

Respectfully submitted,  
OGDEN N. ROOD,  
*Professor of Physics.*

Columbia College, May 16, 1887.

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## DEPARTMENT OF ENGINEERING.

*To the President of Columbia College :*

I have the honor to report that during the academic year just closed, the Engineering Department of the School of Mines has progressed favorably, and I hope and believe has advanced measurably in the character of the instruction afforded to students.

It has been my constant aim to make the instruction in the engineering department each year more efficient by introducing such improvements in methods of teaching in all branches as may have been derived from experience and are otherwise found to be desirable.

The engineering department differs from all others in the School of Mines in many respects; and especially in this, that while the different branches of engineering, civil, mining, and sanitary, which are designated as separate courses have many distinct features, yet there are so many subjects common to all that it becomes necessary to assign the subjects to the different instructors in such a way as to harmonize and render complete, as a whole, the instruction prescribed for each course. In this way only can be prevented harmful repetitions and interferences by different instructors, and in this way only is it possible to take advantage of special aptitude for any subject on the part of any particular instructor.

A want of proper text-books, which is felt in all technical schools at the present time, renders it necessary, moreover, to give constant attention to methods of instruction—to discard unimportant details, and yet to give thorough attention to fundamental principles and their illustration by special examples. To this end our only resource is to have diagrams constructed, ample in number and specific in character, which the students may copy, and which include the essential elements of every subject in each course.

More and more attention is given each year to the illustration of these elementary principles by requiring the students to solve constantly such examples as are sure to be met with in practice. The facility and correctness exhibited by the last class in these exercises was remarkable, showing that the mode of instruction is in the right direction.

I have had occasion to speak of the summer schools in my letters transmitting the reports of Professors Monroe and Hutton, but cannot refrain from again bearing testimony to the excellent and thorough character of these schools.

In the branch of instruction designated as Engineering Design, the appointment of Mr. Stuart as an instructor with the title of Fellow, will be of very great benefit and advantage. In regard to this branch of the drawing department I do not hesitate to say that the efficiency of an engineer may in most cases be measured by the facility with which he can put his ideas and plans into the form of a properly constructed drawing—a kind of written language that may, if properly done, be read by the workman as well as by the engineer. A working drawing properly made is an expression of ideas in a sort of universal written language. This is everywhere recognized, but there are few who appreciate the immense value of this written language as a mode of self-instruction. The drawing board suggests ideas while it detects errors, and in this respect is a most valuable instructor.

In the Department of Drawing proper, where the art of drawing is taught, a very great improvement has been made during the year, since Mr. Mayer was put in charge. This department is now under better supervision and discipline than it has ever been before.

During the past year Professor Ware kindly offered to give six lectures to the engineering students with the architects, on Descriptive Geometry; the assistants in drawing being present at the lectures with a view of giving the students practical examples to work out in the drawing-room as supplementary exercises. This course of lectures to the second class has proved of great profit and advantage.

Finally, while commending in the strongest terms all of the instructors in my department for their industry and zeal, I beg to reiterate what I think I have said substantially in other reports,—that I conceive it to be the true aim of instruction in the School of Mines to teach students how to investigate for themselves, and while affording them the opportunity to acquire general principles and to gain a broad knowledge of experimental and scientific facts and laws, to instil into their minds scholarly ambition and a love of truthful and thorough investigation. To make them self-

reliant in the true, manly, and scholarly sense of the word, rather than to lead them to rely on what others may have said or done.

Very respectfully submitted,

W. P. TROWBRIDGE,

*Professor of Engineering.*

Columbia College, May 16, 1887.

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DEPARTMENT OF ARCHITECTURE.

*To the President of Columbia College :*

In establishing a School of Architecture it was obvious that the first thing to do was to form sufficient collections of books and photographs, prints and drawings, so that ample illustrations of the subject-matter might be at hand. But it was not so obvious how such collections could best be utilized in the daily routine of instruction. It was at first attempted to use this material in the illustration of lectures. But a lecture is best helped by a small number of large-sized illustrations, whether models or diagrams, and it proved impossible to use to any advantage the large amount of small-scale material which necessarily make up the bulk of our collections. The only thing to do was to use diagrams or the blackboard during the lecture, and to refer the students to the book-shelves and portfolios for more detailed information. But such researches, when thus left to personal zeal and enterprise, were unsystematic and unfruitful, even to the few who undertook them; while for most of the class the collections might about as well not have been formed. The worst of it was that the more orderly and comprehensive I made the presentation of my topics, the less need did my students feel of supplementing it at the original sources of information, so that the better I did my work the more unsatisfactory was the result. To meet this difficulty, I at first, as mentioned in previous reports, resorted to the device of confining my own work very much to generalities, leaving it to the different members of

the class to study up special topics and present them in proper shape. In fact, I had the students lecture to each other. The direction of these separate studies, and the revision of the material collected so as to make sure that it was in presentable form, made, of course, rather more work for me than if I had kept the lecturing in my own hands. But it was better for the students, giving each in turn not only a certain amount of practice in research, but valuable exercise of a purely literary kind both in reading and writing. But though each student thus became quite at home in the two or three subjects that fell to his lot, on other points he was no better off than before, and often not so well, the apprentice hand of the lecturer not always being a sure one.

I have accordingly this year employed another method. This is the year in which Mediæval Architectural History is studied, the Third- and Fourth-Year students taking the subject together, and making a single class of eighteen members. To this class I gave during the first half of the year a course of about a dozen lectures, in which the whole subject was rapidly gone over. The class did very little work in connection with them, most of their afternoons being at that time occupied with problems of design. As the mid-year examinations approached, however, I assigned to each student a special topic, upon which he was to prepare materials for an essay, indicating various sources of information in addition to the notes of my own instructions which he or his fellows had taken down. The class took this in excellent part, worked at their several subjects with great zeal, and wrote out from memory during the half-dozen hours given to the examination an exceedingly creditable series of papers, two on each of the nine topics suggested—Vaulting, Tracery, Mouldings, Carving, and Sculpture, Wooden Roofs, and Byzantine, Romanesque, and Gothic History. These papers have during the second term formed the basis of a review of the ground in detail. Each topic has been taken up in turn, a week or fortnight being given to its consideration. At the beginning of this period, the

two examination papers, reviewed and corrected, have been read to the class by their authors, and at the end of the time each member has reported to the class whatever new information or additional illustrations his own researches have brought to light. That these studies might be at the same time exhaustive and independent, the illustrative material at command was divided into nine groups, each comprising a certain number of books, photographs, and prints, and each group was assigned to two young men to be explored, the assignment being changed with every new topic. It thus happened that all the material was systematically examined on each occasion, and that each student, by the time the term was finished, had made the tour of the whole. This has, of course, taken a good deal of time, and the problems in design have meanwhile been largely interrupted. Their place, however, has been made good in part, so far as drawing goes, by the sketches or diagrams the class have prepared in illustration of their reports.

These reports have been presented in a two-hour exercise. They have been more interesting and instructive, and have held the attention of the class much better, than the more formal discourses of previous years, while the more frequent, if briefer, practice in the presentation of carefully prepared and well-arranged material has been an equally valuable experience. The work has steadily improved in character as the term has advanced. A similar system was tried with the same class in the instruction in the Decorative Arts, with equally satisfactory results.

In the History of Ornament, the Third- and Fourth-Year classes have during the past year studied the Ancient, Oriental, and Classic styles. The subject has, as in past years, been treated in weekly lectures, upon which one student each week has been required to hand in a written report. Hektograph copies of these reports, distributed to the class, have thus furnished to every one in the course of the year a reasonably complete set of notes on all the lectures of the course. This has been of great value to the whole class for reviews and for reference, while the literary practice thus



afforded in recasting and editing the hasty notes of the class-room has been of great service to each in turn. Still further to systematize the work and to render the collections more available, a complete syllabus of the lectures has been prepared and printed in advance, giving, besides the topics and sub-topics of each lecture, a full list of the references and illustrations to be found in the libraries and collections accessible at the college. A considerable part of the exercises in drawing has also been devoted to illustrating these lectures either by sketches, tracings, or original designs, thus compelling the students to a more thorough study of the particular forms belonging to the styles under investigation. This work, as well as the general conduct of the drawing-room, has as in previous years been in Mr. Hamlin's hands, entirely to my satisfaction and to that of my young men.

Equally important and salutary changes have this year been made in the work of the Second-Year class. The subject of shades and shadows had, for the first time, been given them in their first year, and the time thus gained was used to great advantage to improve the elementary work which occupies a chief part of the second year. To the study of the details of columns, capitals, arches, etc., etc., was added a series of exercises in drawing out, from prints or photographs, famous buildings in which these details occur. The class thus found practical employment for their knowledge as fast as they acquired it, and were thus confirmed in its possession, while at the same time getting some preliminary training for the exercises in design for the next year.

The lectures on Ancient Architectural History given to this class have been supplemented by the use of Reber's *History of Ancient Art*, as a text-book. Each student has been given half a dozen pages at a time to report upon, and has been required to furnish an abstract, or table of contents, of the paragraphs in question, with notes and illustrations drawn from all available sources. This kind of recitation has proved very satisfactory, sixty or seventy pages

being gone over in a two-hour exercise. The whole class are examined, of course, on the whole book.

The First-Year class have this year for the first time been brought daily into the department, all their drawing during the second half of the year being under my direction. In this they have made unusual progress, owing in great part to the adoption of a somewhat novel method of work. The material they have used in making copies has been carefully varied from that of the original, prints and drawings being copied with the brush, photographs with the pen or pencil, and water-colors in black and white. This has made it impossible to draw without thinking, and has thus cultivated an intellectual as well as a merely mechanical diligence. The method, moreover, by substituting a work of interpretation for that of mere copying, not only avoids the impossible attempt to produce *fac-simile* imitations, but secures for exercises from the flat much of the advantage sought to be obtained in drawing from the round. The class have had a lecture on drawing or on shades and shadows once a week, and have, altogether, gained a position which will enable them to undertake their architectural work, when they come to it in October, to much better advantage than any of their predecessors.

In addition to the stated instruction I have also, as in the previous years, illustrated with the Magic Lantern the subjects pursued in the department, occupying one of the Law School lecture rooms one evening a week during the spring. It was my privilege also to distribute to my classes, tickets for the lectures delivered under the auspices of the Archæological Institute of America, both for those given by Dr. Waldstein, Professor Gildersleeve, Professor Merriam, and Professor Goodwin, and for the ten lectures upon the Archæology of Rome by Professor Lanciani. Most of my young men gladly availed themselves of these opportunities, greatly to their profit.

Towards the end of the year the graduating class have had three or four weeks' instruction in modelling, for which I was glad to secure the temporary assistance of Mr. Edward A. Spring of Perth Amboy.

But though much more and better work has been done in the department than in previous years, this better organization and greater efficiency have served to show, only more conclusively than before, that there is not time, as the course has been so far conducted, for many things that ought to be included in our curriculum.

The establishment of an Architectural Laboratory, for example, which six years ago was proposed as an immediate object of endeavor, has so far proved impracticable, quite as much for lack of time as for lack of space.

Meantime it has become clear that a larger share of time has been assigned to some topics, notably to the Mathematics of the second year, than can properly be afforded to it. With the cordial coöperation of the Departments of Mathematics and of Engineering, I have accordingly prepared a somewhat different arrangement of work for the next year, by which we hope that time will be found for studies hitherto too much neglected. How far these expectations are justified, I shall be able to report next spring.

Yours very respectfully,

WILLIAM R. WARE,

*Professor of Architecture,  
School of Mines.*

May 14, 1887.

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## REPORT OF INSTRUCTION IN BIOLOGY AND HYGIENE.

*To the President of Columbia College :*

I have the honor to report that during the past year I have delivered two courses of lectures to the students of the third class in the School of Mines. The first course of ten lectures, delivered in October and November, 1886, was devoted to general principles of Biology and human Anatomy, with practical applications as to methods of treating accidents and injuries in the absence of a physician or until

one can be procured. The second course of ten lectures was devoted to Hygiene, and especially to food, air, water, and modes of disposal of excreta and waste products.

In addition to these lectures I have exercised a general supervision of the Laboratory course in Microscopy and Biology, which is under the immediate direction of Dr. Julien, whose report is enclosed herewith. With the additional room for this kind of laboratory work which has been furnished, it will now be possible to give practical instruction to all the students who take this course, provided that the necessary time can be allowed in the arrangement of the schedule of recitations and lectures.

I have given special attention during the year to the selection of those books and periodicals of the greatest practical importance in Microscopy and Hygiene, and have notified the Librarian of these desiderata, keeping within the limits of the amount appropriated for the purchase of books in this Department.

Respectfully submitted,

JOHN S. BILLINGS,

*Lecturer on Hygiene.*

Columbia College, May 16, 1887.

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### REPORT ON INSTRUCTION IN MICROSCOPY AND BIOLOGY.

*To the President of Columbia College :*

The following is a statement of the work done during the past year in the Department of Microscopy and Biology, by the following classes :

Second Year, Chemical Course,

Third Year                   “

Second Year of Sanitary Engineering.

Two sessions of two hours each per week were given to each class of the chemical course, the students in Sanitary Engineering attending at the sessions of the Second-Year

Chemists. I have thus given eight hours per week of my personal attention to practical laboratory instruction, usually preceded by a lecture. The preparation of materials, apparatus, and reagents, in readiness for my classes, has further required about four hours' additional labor each day during the week. In the courses of study pursued special attention is given to practical laboratory work rather than to mere recitation. This has been carried on simultaneously with the course of lectures delivered by Dr. Billings, under whose direction and advice my plans of work have been laid out. As the time assigned is limited—four hours per week for each class—it has been by no means easy to include, in each short session of two hours, a brief lecture, the practical laboratory work by the students, and their preparation and putting away of the necessary apparatus. It would be therefore highly desirable to aggregate the time of each class into a single session of four hours' length each week.

The class of Second-Year Chemical students have been instructed in the construction, care, and use of the microscope and of its accessories, in drawing and measuring objects under the microscope, and determining magnification in the various methods of preparation and mounting of objects, and in the special use of high-power objectives; also in various practical applications of the microscope to the examination of textile fibres and fabrics, papers, the study of ink-lines and handwriting, and especially to microchemical examinations and the study of crystals on the stage of the microscope—a subject of special interest and importance to chemical students. The improved accommodations and facilities have decidedly aided the progress of this class. The Museum has received this winter, through Dr. Chandler and an alumnus of the School of Mines, a valuable collection of fibres and fabrics for these purposes.

The Third-Year students of the Chemical course began the year with instruction in photomicrography—a course laid out with the purpose of enabling every student to obtain for himself, with the simplest apparatus—an ordinary

camera, microscope, and oil-lamp—a satisfactory photograph of any desired microscopic object. This requirement has proved to be of great value, in supplement of natural deficiencies in drawing, and particularly in increasing the interest of the student in the object itself under study. For this purpose a little adjoining closet, which was found to be empty and almost unused, has been called into use this winter as a camera-room, in which exposures could be going on, free from jar caused by passing wagons, or by the tread of the other students engaged in laboratory work. The same students then began their course in Biology proper by the study of common unicellular forms of life, such as yeast, the common moulds, the green protococcus adhering to the stones in the college buildings, the infusoria, desmids, diatoms, algæ, etc., in the fresh and salt water in and around this city. A course of bacteria investigation was then carried through, occupying the larger portion of the winter, with special attention to the bacteria in the air and Croton water, and to the testing of disinfectants. Then followed the study of blood and absorption-spectra, urinary deposits, tissues, and the dissection of the frog. In this class, therefore, our students, for the first time in the history of the college, have been carried through the courses of study initiated two years ago, covering the use and applications of the microscope, bacteria investigation, and the general principles of biology.

Our proposed Course of Sanitary Engineering has also been initiated this year by the entrance of two painstaking students, who are proceeding through a course of study for the most part like that of the Second-Year Chemists. I may add that the few hours per week, during this course of two years, are indispensable for the special and difficult work required from a properly trained Sanitary Engineer.

Our rooms and apparatus have been constantly at the service of the students beyond the prescribed hours, and they have availed themselves frequently of the opportunity during the afternoons. We have also been glad to welcome the

voluntary attendance of representatives of other departments of the School of Mines from time to time.

Much of my time during the past year has been taken up in the completion of lists of books, from which and from his own, Dr. Billings has made selections for the increase of our working library, which has been constantly open to the students for reference.

Respectfully submitted,

ALEXIS A. JULIEN,

*Instructor in Microscopy and Biology.*

Columbia College, May 16, 1887.

## REPORT ON GEODESY AND PRACTICAL ASTRONOMY.

*To the President of Columbia College :*

I have the honor to report as follows on the work in my department in the School of Mines :

(1) *The Fourth Class*, in Geodesy, met me once a week up to January 10th, and from that time twice a week. The subjects dealt with were nearly the same as last year, but the extra hour allowed by the Trustees, on recommendation of the Faculty, enabled me to treat the subjects more fully and satisfactorily than heretofore. The class numbered fourteen the first term, and thirteen during the second term.

(2) *The Third Class*, in Astronomy and Geodesy, met me twice a week during the year. The instruction was nearly the same as that given to last year's class. The class numbered eighteen.

(3) During the first term a section of nineteen students of the third class, and during the second term a section of twelve students, have attended me twice a week for instruction in Mechanics, except at times when Prof. Peck lectured the whole class.

(4) *Post-Graduate Class.* During a part of the year (five months) two graduates have attended me once a week to read books on *Methods of Least Squares*.

Respectfully submitted,

J. K. REES,

*Professor of Geodesy and Practical  
Astronomy.*

Columbia College, May 9, 1887.



**APPENDIX C.**

SCHOOL OF POLITICAL SCIENCE.

REPORT BY THE SENIOR PROFESSOR.

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*To the President of Columbia College :*

The students in the School of Political Science have received instruction in all the subjects contained in the enclosed schedule of studies, taken from the Handbook of Information of that School for the present year, and by the persons and for the number of hours per week therein prescribed.

The attendance upon these courses is steadily increasing from year to year. During the past year seventy-three persons matriculated for the full course leading to the Doctor's degree, while a much larger number from the Senior class in the School of Arts and from the two classes in the School of Law have attended such lectures as they have been permitted to by the statutes of the college.

Most gratifying of all, however, is the marked development of the spirit of research among the students of this school. I am informed by the Chief Librarian that they are constant in their use of the library, and pursue their work there with great zeal and patience, and his testimony is fully corroborated by the results of their study, manifested through the literary productions which they are able to offer us.

This school has yet three great needs. The first is a far greater expansion of the library in the direction of original documents. The second is a full and minute course upon the History of English Law ; and the third is an ex-

tended course upon the methods of constructing history from original material.

We are endeavoring to develop the talent for these two subjects in some students now in attendance upon the School, and we trust that, at no far distant day, these wants may all be amply supplied.

*The Political Science Quarterly*, edited by the Faculty of this School, has been well received both in this country and abroad, and has already become self-supporting. Thanks are due to the many eminent scholars in History, Jurisprudence, and Political Economy who have aided us by contributions in this work.

Respectfully submitted,

JOHN W. BURGESS,  
*Senior Professor in the School of  
Political Science.*

Columbia College, May 16, 1887.

## *DEPARTMENT OF POLITICAL ECONOMY AND SOCIAL SCIENCE.*

*To the President of Columbia College :*

The undersigned has the honor to report as follows concerning the work in this department during the past year.

First-Year students have attended lectures on historical and practical political economy, four hours per week during the entire year.

Second- and Third-Year students have heard lectures on communism and socialism, one hour per week during the entire year.

The department has been greatly strengthened by the zeal and labors of Dr. Seligman, one of the prize lecturers. He has lectured two hours per week during the year on the History of Political Economy, and three hours per week

during one term on Railroad Problems. The latter lectures especially have excited great interest, and attracted a large number of students.

Respectfully submitted,

RICHMOND M. SMITH,

*Professor of Political Economy and Social Science.*

Columbia College, May 17, 1887.

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### REPORT ON INSTRUCTION IN EUROPEAN LAW.

*To the President of Columbia College :*

I have the honor to submit the following report in reference to my work in the School of Political Science during the past year.

I lectured five times a week through the year, to the students of the Second class, upon Roman Law and Comparative Jurisprudence. A sixth hour each week was devoted to examination upon the preceding lectures. This course was attended by nearly thirty students, twenty-three of whom presented themselves regularly for the weekly examination.

During the months of March, April, and May, an optional course of readings from the Digest was offered to the same class, one hour each week. This course was attended by six students.

I also delivered one lecture each week during the greater part of the year, to the Third-Year students, upon Private International Law.

Respectfully submitted,

MUNROE SMITH,

*Adjunct Professor of History and  
Lecturer upon Roman Law.*

Columbia College, May 16, 1887.

## DEPARTMENT OF PHILOSOPHY.

*To the President of Columbia College :*

The First-Year class has attended three hours a week throughout the year. These hours were occupied by lectures on the History of Political Theories from Plato to Bentham.

Respectfully submitted,

ARCHIBALD ALEXANDER,

*Professor of Philosophy.*

Columbia College, May 16, 1887.

**APPENDIX D.**

**SCHOOL OF LAW.**

**REPORT FROM THE WARDEN.**

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*To the President of Columbia College :*

The Warden of the Law School would respectfully report as follows :

The attendance of the students and their devotion to the studies assigned to them by the statutes have been highly satisfactory. The Senior class has pursued the rules of Equity Jurisprudence under Professor Lee, and the topics of Evidence, Torts, and the Code of Procedure under Professor Chase. In the topics of Shipping and Insurance they have been instructed by Professor Dwight. They have also under him a review of the law of contracts. They have been reviewed by Professor Lee in the Law of Real Estate. Professor Ordronaux has delivered his regular course of lectures in Medical Jurisprudence, and Professor Chase a course of voluntary lectures in Criminal Law.

The Junior class has studied under Professor Dwight the general outlines of Municipal Law, and more particularly the Law of Contracts, and under Professor Lee the Law of Real Estate.

Each class has been divided into two sections, so that the professor in charge has been obliged to conduct two exercises each day on the same subject.

The Moot Courts have been conducted with much spirit on the part of the students. These exercises are in a high degree beneficial, and contribute greatly to bridging over the distance between the work of the class-room and the business of professional life.

The number of students in the Senior class has been one hundred and sixty-four; in the Junior class, two hundred and forty-six. The graduating class of 1886 numbered one hundred and ten. Forty-nine literary colleges are represented among the students of this school.

The first-, second-, and third-prize tutorships, filled by the appointment of Mr. Charles E. Hughes, Mr. Robert D. Petty, and Mr. Paul D. Cravath, have proved highly useful, and have more than justified the expectations I entertained of its success in recommending the adoption of the tutorial system. They have been attended by the students in regularly increasing numbers. Mr. Petty has instructed the students in the rules of Common Law Pleading. Mr. Isaac L. Rice has as last year, acted as instructor in the preparation of legal briefs and the use of legal decisions.

Respectfully submitted,

THEODORE W. DWIGHT,

*Warden of the Law School.*

Columbia College, May 16, 1887.

**APPENDIX E.**

**SCHOOL OF MEDICINE.**

REPORT BY THE SECRETARY OF THE FACULTY.

*To the President of Columbia College :*

In behalf of the Department of Medicine I have the honor to report as follows :

Upon the 23d of April, 1887, the last lecture was given of the last session to be held in the building on the corner of Twenty-third Street and Fourth Avenue, which has, with rapidly increasing difficulty, served the needs of medical teaching for thirty-one years. There can be no stronger commentary upon the rapid growth of medical science than is furnished by the completely antiquated character assumed in a single generation by a medical college building considered ample for all possible purposes when erected.

During the summer of 1887 this college will move to its new property, the gift of the late William H. Vanderbilt, upon Fifty-ninth and Sixtieth streets, between Ninth and Tenth avenues.

The new college building and the buildings of the Sloane Maternity Hospital and the Vanderbilt Clinic are all rapidly approaching completion. The property of this department, at the corner of Twenty-third Street and Fourth Avenue, has been advantageously sold for the sum of \$160,000.

The number of matriculates in medicine for the calendar year 1886 was six hundred and six (606), an increase of one hundred and four (104) over the year 1885. Of these, thirty-one per cent. (31 %) were, on matriculation, possessed of degrees, viz.:

In medicine.....	70
In arts, philosophy, and science.....	119
Total .....	189

In September, 1886, there were examined, for the degree of M.D., twenty candidates. Of these, three failed to pass, equal to fifteen per cent.

The candidates (119) for graduation in May, 1887, are, at this writing, undergoing final examination.

Respectfully submitted,

JOHN G. CURTIS, M.D.,

*Secretary of the Faculty.*



**APPENDIX F.**

**REPORT ON THE SCHOOL OF LIBRARY  
ECONOMY.**

BY MELVIL DEWEY, PROFESSOR OF LIBRARY ECONOMY.

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*To the President of Columbia College :*

The first session of the Library School has proved more successful than we had dared to hope for the experimental year in a new field. I confine this report to brief mention of the many topics of interest.

**Attendance.**—The trustees were told, when the School was proposed, that there would doubtless be not less than five nor more than ten pupils. But many of the applicants were so urgent that, after rejecting an equal number for various reasons, we admitted twenty to the class. We again wished to limit the new additions to ten, but from the number of applications already received, it is probable that not less than forty will apply before the opening of the second year. This is gratifying evidence of general interest, and will make it practicable to select the best material from a large number.

These candidates are not merely local students representing merely a local interest. Only two are from this city, and after New York and Massachusetts, which send five each, no State has more than one student in the School, while the field represented extends from California to Old England.

**Extent of Course.**—For the first year there was offered only a three months' course, an error on the conservative side, most of the class expecting to return home after these three months. At the middle of the term, however, they

unanimously petitioned for an additional month, which was granted. At the end of the fourth month more than half of the class had determined to take a full two years' course, and thus make a more thorough preparation for their life-work than was possible in a shorter time.

Two years' experience has shown: 1. That there is important and valuable work which can be done profitably, sufficient to fill a two years' course. 2. That there are more than enough candidates who wish to take such a course. 3. That there is a rapidly increasing number of libraries wishing librarians, catalogers, and assistants so trained, and willing to pay a better price for their services.

It is still believed, however, to be best that the course of the past year should be continued; less than is demanded being offered rather than more; admitting a small number of students of superior education and natural abilities, rather than aiming at a greater apparent success by encouraging increase of numbers and extending the course to the limits of possibility. The circular for the coming year, to which reference is made for much information that this report should cover, offers, beside the three months' course, a previous preparatory term of eight weeks and a subsequent apprenticeship term of eight weeks; thus giving seven months of solid work, with as many exercises as is usual in a professional school year. The circular gives in detail the ground covered in instruction and describes the plans used.

A fair criticism on the past year's work has been that too much was attempted for the time; some of the class seeming to work in the library all the time from 8 A.M. to 10 P.M., with the exception of brief intervals for lunch and dinner. The greater average age of our students and the very unusual interest and enthusiasm which they have all displayed in their work have made them equal to the strain upon their powers; and inquiry has shown, with a single exception, an actual improvement in health during the term, instead of the general break down feared by some. Lengthening the year from three to seven months will make it possible to

increase the course substantially, and also to avoid hereafter too great a pressure.

**Lectures.**—Lectures and visits to city libraries averaged three per day for the sixteen weeks. But not a few of these exercises occupied not less than two full hours, and in addition there were almost as many hours of instruction under the teachers not counted in this total.

Of the two hundred and twenty-eight lectures given before the School, ninety-nine were given by the regular library staff, fifty by myself, thirty-two by Mr. W. S. Biscoe, and seventeen by Mr. G. H. Baker. Beside these ninety-nine there have been given one hundred and thirty other lectures, not counting the allied lectures nor those given Saturday mornings in the large room. Visitors have been present at more than half the lectures of the course, some of them coming from distant points and staying at the School from a single day to two or three weeks. Some of the regular lectures have been in the large rooms of the Law School, and interested audiences of from fifty to over two hundred have been present, many of whom have expressed themselves very warmly as to the value of what they have been privileged to hear.

Great obligations are due to some thirty prominent librarians and specialists, whose names are given in the annual register, who have given during the past session more than half of the over two hundred lectures, on account of the interest they have taken in the School and their faith in the good to come from it to the whole library profession. None of these lecturers have received any salary; for the trifling receipts from tuition fees, which was all it was possible to divide among them, barely paid travelling expenses; and in some cases even these have been borne by the speakers.

The bibliographical lectures given by our own professors of the various schools have been conspicuously and without exception practical and useful, and will be a feature of great value to the college when opened to the attendance of the students from all of the schools.

**School Hours.**—The class came in at their convenience after 8 A.M. and worked till 9.30 A.M. in the main library or at their tables in the old library. From 9.30 to 12.30 they worked under the teachers, who went from table to table answering questions, inspecting work, criticising and suggesting, and often to little groups illustrating and explaining at black-boards. From 12.30 to 2.30 each used the time as he saw fit, but, except a half hour for lunch, nearly all gave it to school work.

The first daily lecture was at 2.30, the second at 4 P.M., but, instead of a half hour between the two for completing notes and rest, there has been this year only five minutes; and after the four o'clock lecture the class has often kept up a sharp discussion till 5.30 or 6 P.M. In the evenings there have been few class exercises, but some of the students have worked regularly in the library till 10 P.M.

**Courtesies Received.**—There have been many invitations for evening lectures, exhibitions, etc., to which friends knowing the character of the School have sent complimentary tickets. Of the many outside lectures, exhibitions, etc., perhaps none were more highly appreciated than Prof. H. H. Boyesen's course of six lectures on the English poets, given in the Lyceum Theatre during Lent.

Several publishers have expressed their interest in the class by supplying as outright gifts, or at nominal prices, books needed, and the considerable collection of books, pamphlets, blanks, samples, etc., which each student has made, with the notes accompanying, must prove of the utmost practical value hereafter. Similar concessions to the class have been made by publishers of periodicals most valuable to the librarian, and nearly every student has profited by these unusual opportunities. The College Observatory staff kindly gave the class an entire evening, and explained the instruments and afforded opportunity to examine the moon, Saturn, Jupiter, and star clusters through the Rutherford equatorial. On alternate Friday evenings the class has met socially with Mrs. Dewey at 48 West 59th Street, where the hard work of the week has given place to

music, simple refreshments, and general library good-fellowship, which has helped to develop the "esprit de corps" so evident in this pioneer class.

**Inspections.**—By invitation of Mr. George Hannah, librarian, the class and teachers enjoyed a delightful lunch in ideal surroundings in one of the beautiful library rooms of the Long Island Historical Society.

Wednesday afternoons have been used for practical lessons in library economy by visiting and thoroughly inspecting the libraries of New York and Brooklyn. The order of the eighteen visits was: Mercantile, Young Men's Christian Association, Astor, New York Free Circulating, Ottendorfer, Neumann's bindery, Harper Brothers' printing house, Aguilar, Maimonides, Apprentice's, Brooklyn Young Men's Christian Association, Long Island Historical Society, Brooklyn (formerly Mercantile), General and Union Theological Seminaries, and the Lenox. These visits have proved most profitable. The class has gone not as sight-seers but with distinct notions of what they wished to learn. The utmost courtesy has been shown in every library, the officers leaving other duties and giving the afternoon to explanation of their building, arrangements, and methods. The routine of each library has been carefully examined in detail, students have been freely supplied with examples of blanks, etc., illustrating the methods used, and copious notes have been taken. On the following day I have given a quiz or oral examination. On such occasions each student states what he learned from the last preceding visit that may be of practical service hereafter. The wide-awake comments and discussions impressed the practical lessons of library economy much more closely, after having seen the methods in actual operation the day before. These examinations often required several hours, time being taken to compare other methods, and show samples collected from other libraries and at hand in the American Library Association Museum of library appliances, which is arranged in the class-room. These quizzes afforded opportunity to correct any errors and to add to their notes points

not appreciated till brought out by discussion, questions, and suggestions of the class. It would astonish the librarians themselves to hear how much these twenty earnest seekers after helpful suggestions have together found in each institution visited. Very little escapes all their eyes, and in the quiz whatever was seen by any one was brought out and made the common property of all. Free criticism has been allowed, and there have been champions on opposite sides of most questions, thus guarding against that narrowness which assumes that the methods of any one library were necessarily the best for others. In this way seventeen libraries were studied from actual inspection, besides as many more from printed or written explanations of their methods supplemented with pictures, samples, etc., to serve as object lessons. As each topic is discussed in the regular lectures, these visits are again utilized by drawing out from the class the places where they saw the point practically illustrated. The skill and enthusiasm with which all this work has been done have received from visiting librarians, and have merited, the highest praise.

**Language Lessons.**—This experimental class has made plain many wants and often also the satisfactory means of supplying them, *e. g.* they have had some exercises, which next year are to be made more prominent, called library language lessons. An experienced teacher, familiar with the details of cataloging, and with German, French, Italian, Spanish, and Latin gave a short course in those things that catalogers constantly need in handling books in various languages. This included drill, *e. g.* in genitive forms of authors' names that must be turned into nominatives, and specially the title-page vocabulary, with tables of the words in each language for *revised, enlarged, illustrated, edited, translated*, etc., etc. The object was to make those who have a reading knowledge of the languages more familiar with this special side, and to help those with only a slight knowledge to avoid the mistakes to which they are most exposed. The class were shown with comments and warnings a kind of errors into which catalogers have fallen from lack of familiarity with the languages.

**Problems.**—Admirable work was done under the topic, *buildings*. Specifications of actual buildings about to be erected or remodeled, with exact circumstances, funds, measurements, etc., were given as class problems. One was a new building, another the remodeling of a church into a library, and a third the enlargement and great development of a library already built. The plans brought in were certainly above the average from as many architects, as far as practical library requirements were concerned ; and in at least one case a building committee is now following a plan thus worked out in this School.

Problems, small and great, coming from all parts of the country, have been thus used to test the class. Valuable contributions to library economy, as well as student exercises, have sometimes resulted. Among other things the class made lists of books for purchase, model blanks, notices, etc., and chiefly each member was required to write a thesis giving in a single paper an idea of his grasp of the subject. First he describes the library to be treated, its location, size of town, character of population, amount of annual income, present stock of books, library government, and size and shape of buildings, if there be any. This shows the idea in the mind of the pupil. Then each thesis states what the writer advises as the best plan to develop interest, raise funds, secure or erect the building, and furnish and equip it. Then comes the government and service, regulations for readers, giving in detail all needed rules. Then follows the detailed scheme of administration, selecting and buying books, the system of records, catalogs, classification, shelf arrangement and numbers, loan system, reference work and aids for readers, binding, duplicates, and indeed all details for conducting the library in the best way.

The work handed in indicated a most gratifying clearness of comprehension, and so wide a variety in the excellent plans laid out, that no one after reading the theses would feel that the School was moulding all its pupils to one Procrustean model. They are learning to think clearly and independently, and to look out sharply for mistakes ; and

their detailed plans, laid out in imagination, contain, on the average, fewer blunders than can be found in the same number of libraries managed by librarians with the experience of years.

In many ways there have been expressions of interest in the School beyond what is usual, and in repeated cases it has been intimated by officers or owners that the School is looked to to supply hereafter librarians or catalogers to certain prominent public libraries, and also to comparatively small private collections. No more practical approval of the work here done could be desired than this expression of a wish to secure the services of the graduates of this School.

In short, the School has been full of hard work, but also full of enthusiasm and helpfulness and inspiration to all concerned. Those who doubted its success have been wholly convinced, when they saw what had been accomplished in the first year and the abundant promise of still better work in the year to come.

Respectfully submitted,

MELVIL DEWEY,

*Professor of Library Economy.*

New York, June 20, 1887.



*THE LIBRARY.*

**APPENDIX C.**

*REPORT ON THE LIBRARY.*

BY MELVIL DEWEY, CHIEF LIBRARIAN.

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*To the President of Columbia College :*

I beg to submit herewith my fifth annual report on the Library of Columbia College, covering such points as are not sufficiently treated in the annual Circular of Information, and the annual statistical tables and notes, to be printed after the close of the financial year.

**Public Gatherings in the Library.**—The great hall of the library was made the scene of a large and brilliant assembly of students, alumni, and citizens, on the second day of June inst., on occasion of the celebration of the class-day exercises of the graduating class. The literary performances sparkled with wit, humor, and genuine eloquence, and were received with enthusiastic applause. In the evening of the same day was pronounced, in the same place, the annual oration before the Society of the Phi Beta Kappa ; which was this year delivered by Professor Charles Sprague Smith. Prof. Smith chose for his theme the interesting topic so largely at present occupying attention in the educational world, "The American University." The oration was listened to by a large and deeply interested audience, and produced a profound impression.

A little earlier in the year, viz., on the 13th of April, the day of the Centennial Commemoration of the revival, after the Revolution, of the royal charter of the college, at a grand reception given in the evening on the college grounds, by the President, Faculties, and Alumni, to the Trustees,

invited guests, and distinguished citizens generally, the Library Hall was again the central point of interest, and was thronged almost to suffocation. The assembly, amounting to some thousands, was probably the largest ever gathered in this city at any festivity not of a public nature ; and the general enjoyment and universal expression of satisfaction amply repaid the labor incident to the preparation of the rooms and grounds for so unusual an occasion.

**Building.**—The pressure for increased room for storage of books has become urgent. Slight temporary relief has been gained by shelving over the great chimney-breasts in the east and west ends of the main hall, giving room for fifteen hundred volumes. Four double-faced cases, holding about one thousand volumes, have also been introduced into the long room on the fourth floor, dividing that room into two of smaller dimensions. As these cases occupy space previously unavailable for readers, being obstructed by a stairway and water tank, there is little loss by the change ; and the entire library of political science can now be shelved together. The water tank has been removed to the eighth floor, by which means space is gained, the noise of running water avoided, and better service secured in other respects. The new shelving thus provided barely holds the present year's growth, and need of larger space remains as great as before. During the present summer a second gallery will be built by order of the Trustees in the north transept, which will give room for about three thousand volumes more ; but by the time it is completed that number of new books at least will have been received and will be waiting places ; so that once more provision will only keep pace with growth, without in any degree relieving the overcrowding on the shelves. As has been heretofore urged, it would be true economy to provide liberal shelf room ; inasmuch as labor and wear of books are saved, when it is possible to arrange the volumes in open ranks so that additions may be made to each subject without moving whole tiers or faces to admit a single set. Indeed, were it not for the great advantages of our movable system, we should be com-

pletely blocked. The possibilities of the present building are nearly exhausted, but we can yet put two more galleries on the north wall, and shelve five thousand books ; and, at the same time, get direct access to the sixth floor, now wanting but greatly needed. The new gallery already ordered will afford similar direct access to the fifth floor, which is equally wanting at present. The only remaining possibilities for shelving are on the trusses, and next the ceiling on the sixth floor, where storage for a few thousand volumes can be obtained ; and in the large halls on the first floor, which, by slight alteration, could be prepared for a fire-proof stack, holding perhaps twenty thousand volumes. All this space will probably be required before an enlargement of the building itself could be effected, even if commenced at once. Such an extension would involve the demolition of the old library building, which is as full of books as before the present one was erected. The question of the future seems, therefore, to call for early consideration.

The constant and full use of the old building, which has become unavoidable, suggests the importance of carrying the electric light into that quarter also, where it has been hitherto regarded as unnecessary ; because the valuable books there stored are in danger of fire from the oil hand-lamps, which are necessarily used there many times each evening.

**Important Gifts and Additions.**—Two of the classes graduated within the past fifteen years have asked permission to place in the great reading-room memorial stained-glass windows ; and the series planned some years ago and so admirably inaugurated by the Class of 1885, of the School of Arts, gives thus apparent promise of being carried forward to completion. The class of 1887 intended to embellish the western end of the great hall with an ornamental fire-place as their memorial, but through a misunderstanding as to the character of the design of the structure, the matter has been deferred, it is hoped only temporarily.

The very valuable scientific library of the New York Academy of Sciences is now safely housed on the sixth

floor of the building, and adds greatly to the usefulness of the library, as it contains many transactions of learned societies not elsewhere accessible in so complete sets.

From time to time are received interesting documents connected with the early days of the college. Some of these have been framed, and all are highly appreciated and carefully preserved.

The class of 1886, who gave as their library memorial a collection of American literature, have just increased it by some fifty additional volumes. No other books in the library have been so much called for since their presentation ; and if the members of the class, as it is hoped, continue to add to their collection in the same spirit, they will eventually create here a very satisfactory alcove of American literature.

It will be seen in the annual statistics to be presently printed, that our friends still remember us so largely with gifts, that the total constitutes an important element of increase. The largest single gift of books this year has been from G. D. L. Harrison, Esq., late acting treasurer of the college, who, with his brothers Thomas L. and Richard M. Harrison, have given some five hundred volumes from the library of their grandfather, Richard Harrison, LL.D., trustee of Columbia College, 1788-1829, and of their father, William H. Harrison, LL.D., trustee of Columbia College, 1838-1860. Many of these books have special intrinsic value, aside from their interest as having belonged to a family so conspicuously and honorably connected with Columbia College for three generations.

At the recent sale of the private library of our late lamented professor of Latin, Charles Short, a special appropriation by the Trustees made it possible to secure for the college some fifteen hundred valuable volumes, which form a substantial addition to the classical department.

A very valuable addition to the bibliography of the library (made possible by private gifts) was obtained from the very select library of the late Richard M. Hoe, the inventor of the Hoe printing-press, from which were secured about five hundred volumes.

**Statistics.**—The details of the operations of the library, in which interest chiefly centres, are shown in tabular form in the annual statistics to be prepared for publication at the close of the fiscal year. For greater convenience, the notes on these facts will be appended to the tables, reference to which is only made here in order to avoid repetition. The importance of these statistics for current study, and as the authentic history of the growth and use of the library, justifies their careful preparation. It is found, in comparing the first nine months of the present year with the same period for the year last preceding, that there has been an increase of of ninety-six and nine-tenths per cent. in the number of loans; a most remarkable and gratifying increase over what in its turn was a gain of over one thousand per cent. on the average circulation of the twenty years next preceding it. And this happened, notwithstanding that the practice of taking books from the building has been discouraged as much as practicable. These facts strikingly indicate the growing interest in the library on the part of those who use it, and its rapidly increasing usefulness as an educating instrumentality.

**Visiting Scholars.**—A pleasant feature, which seems to grow with years, is the number of professors from sister colleges, and other scholars and literary or scientific men, who visit this library, sometimes for a few hours and sometimes for several weeks at a time, in order to avail themselves of the resources for information here found. During every vacation quite a number thus present themselves, and it is a pleasure to extend courtesies attended, moreover, with neither trouble nor expense, to a class of visitors of such character—a class whose presence is rather to be courted than repelled.

In the same line is the steady growth in intercollegiate courtesies, by which we both give and receive favors; distant colleges or libraries allowing us the temporary use of books or pamphlets which cannot be found in the market, while we in turn share our own advantages with them.

Occasionally scholars find great benefit from being able to send freely for extracts wanted from books in this library, or for the help of trained assistants to look up

matters for them in connection with their studies. For such services, when rendered, the actual time occupied by the assistant is paid for at cost, so that no direct burden falls on the college, and yet a substantial saving is secured to distant inquirers.

Many expressions of warm appreciation have been received for helps of this kind, and the list of gifts to the library is much enlarged by contributions from friends who wish in this way to give practical expression to their gratitude for such favors.

The most pressing need at present felt is for increased appropriations for the purchase of books. The requisitions from all departments exceed constantly the means at the disposal of the administration, which is, therefore, sometimes subjected to imputations of inefficiency, entirely undeserved. In an appeal to the public made by the Trustees a year or two since, it was suggested that friends of the college might render valuable service by gifts of moderate sums for the endowment of special subjects in the library; and it is the hope of the undersigned to be able to announce, before the close of another year, the first response to this appeal. To meet the present demand upon the library, already created and actually existing, for university purposes, an annual expenditure, for books and serials alone, of twenty thousand dollars is the smallest sum that can wisely be named.

The year has been one of harder work and severer pressure than ever before. Increase in usefulness means increase in labor from the working staff; but without exception, the extra duties and extra hours often made necessary, have been borne in a most satisfactory and hearty spirit of co-operation.

It is a compensation for the toil endured to feel that we are a year nearer to that high standard by which it has been our constant aim to give to this great storehouse of letters the character of a true university library.

Respectfully submitted,

MELVIL DEWEY,

*Chief Librarian.*

Columbia College, June 18, 1887.

*SUMMER CLASSES.*

**APPENDIX H.**  
**SUMMER CLASSES.**

**PRACTICAL WORK IN THE VACATION.**

**I.—SUMMER CLASS IN PRACTICAL MINING.**

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*To the President of Columbia College :*

I have the honor to transmit herewith the report of Adjunct Professor H. S. Munroe on the Summer School of Practical Mining for the vacation following the commencement of 1886 (last summer).

The summer instruction was given at the Atlantic Copper Mine, Lake Superior, and in thoroughness probably excelled that of any previous year. Mr. Woolson, Assistant in Drawing, accompanied Professor Munroe, according to the arrangement and understanding made when he was appointed by the Trustees, and the effect of having a permanent assistant who is also an instructor in the School of Mines, was in every way beneficial.

It is intended that the instruction for the coming summer shall be given in the iron and coal regions of Pennsylvania instead of at Lake Superior.

I beg to refer to Prof. Munroe's report for a detailed account of the work of the students at the Atlantic Mine.

Respectfully submitted,  
W. P. TROWBRIDGE.  
*Professor of Engineering.*

Columbia College, May 16, 1887.

### REPORT.

*To Prof. Wm. P. Trowbridge :*

DEAR SIR.—I have the honor to make the following report on the tenth session of the Summer School of Practical Mining held during six weeks in the months of June and July in the Lake Superior copper region, with head-quarters at the Atlantic Mine, Houghton Co., Michigan.

The following graduates of the School of Mines served as assistants in the Summer School, viz. :

Ira Harvey Woolson, E.M., '85,  
James Jackson Ormsbee, E.M., '86,  
John Howell Janeway, Jr., E.M., '86.

Of these Mr. Woolson, Assistant in Drawing, is assigned for duty in the Summer School by special resolution of the Board of Trustees. The other assistants were appointed under the resolution of the Trustees providing for volunteer assistants. The assistants proved themselves zealous and efficient, and contributed not a little to make the Summer School one of the most profitable and satisfactory ones that we have had.

The following students of the Mining, Engineering, and Metallurgical courses attended the Summer School as required by statute.

D. C. Adams,	Plainfield, N. J.
W. H. Aldridge,	Brooklyn, N. Y.
J. D. Berry,	Newnan, Ga.
J. R. Bien,	New York City.
A. L. Burns,	Brooklyn, N. Y.
E. Z. Burns,	Pekin, N. Y.
W. C. Butler,	Paterson, N. J.
E. D. Church, Jr.,	Brooklyn, N. Y.
H. M. Cole,	Jersey City, N. J.
J. S. Cox, Jr.,	New York City.
J. Lahey,	New York City.
R. Lahey,	New York City.
H. C. Mannheim,	Brooklyn, N. Y.
J. R. Marsh,	Muncie, Ind.



H. P. Nichols,	New York City.
C. C. Restrepo,	U. S. of Colombia, S. A.
Geo. S. Rice, Jr.,	New York City.
L. H. Rutherford,	New York City.
F. M. Simonds,	New York City.
F. McM. Stanton,	New York City.
J. A. Staunton, Jr.,	Syracuse, N. Y.
F. W. Tower,	New York City.
G. F. D. Trask,	New Brighton, S. I.
J. L. Warner,	New York City.
P. O. Wels,	New York City.

Of the above twenty-five men, one belonged to the second class, and was given special permission to attend the Summer School by the Faculty, and one belonged to the graduating class. It was not found necessary to debar any conditioned men this year.

By an arrangement with the officers of the company a large branch building was erected at the Atlantic Mine for the students. The building was so constructed that it could be converted afterwards into a row of tenements. The students were required to pay a nominal rent, and the cost of such extra work and material as were necessary to fit the building for their use. The building was sixty feet long by eighteen feet wide, two stories high, and contained sleeping-rooms for twenty-two students and three assistants, with a large dining- and lecture-room, wash-room, kitchen, and servants' quarters. A cook and two helpers were engaged, and the necessary supplies were obtained from the company stores on very favorable terms. The freedom of camp life was enjoyed by the students, and the fare proved much more palatable than that of the hotels and boarding-houses patronized in former years. By living at the mine much time was saved that otherwise would have been spent in going to and from work. The students also were brought into closer contact with the miners and mine-officers, and with the routine of mine work; they were able to go underground at any time day or night, and thus had a chance to observe many things that they would have lost had the head-quarters been at Houghton.

The following scheme of study was prepared for the use of the students :

## SCHEME OF STUDY.

### I. DRILLING AND BLASTING.

1. *Character of Rock* : Note character and hardness of rock, as indicated by rate of drilling, and by the temper given to the drills. Note presence of slips, fissures, cleavage, and bedding planes, their general direction and frequency, their effect upon the work of blasting, as determining the depth and direction of blast holes, and the amount of ground broken per blast.

2. *Drilling* : Observe methods of setting up machine drills, noting the preliminary work necessary and the total time employed. Note depth and direction of each hole bored, and the number of holes bored from each setting of the machine. Note speed of the drills, time and rate of boring, and time required to change bits. Note accidents and delays from any cause, and time lost by reason of the same. Number of holes bored and total depth per shift, and number of drills dulled. Note weight of machine and its several parts, and methods of handling the same in drifts, stopes, and shafts. Disposal of machine during blasting. Note arrangement of blast holes, and general system of blasting in drifting, sinking, and stoping. Note the number of men employed in each case and the duties of each man. Number of drills, hammers, picks, shovels, and other tools required.

3. *Blasting* : Observe methods of charging blast holes ; kind and trade name of powder or other explosives used ; number and size of cartridges, or weight of powder in each hole. Note kind of tamping used, whence obtained, tools used and method of tamping, and precautions against accidents. Note method of firing blasts, the kind, quality, and length of fuse, and kind of caps or other exploders employed, method of lighting fuse, or details of firing by electricity. Determine line of least resistance, and compute constant as referred to  $L^2$  and  $L^3$ . Obtain data, if possible, to determine radius of projection by Höfer's formula, measuring the angle of the side of the crater formed, or the depth and diameter of the crater if possible. Such measurements should be taken from craters or from portions of craters, modified neither by slips nor by reëntrant angles in the face of work. Observe carefully the position, direction, and depth of each hole bored, and the object of such location, and the relation of the hole to the preceding and following blasts. Observe the effect of the blast, and note signs of an excess of powder, viz.: a flat crater and excessive breaking and projecting of the rock, and crushing of the rock about the blast hole. Note, also, any damage to timber, etc., by the blast. Note, also, circumstances requiring unusually heavy charges, tight corners, presence of native copper, etc. Note the reasons for the failure of any blast to do the work intended. Misfires ; their cause, and precautions taken. Note method of detecting fissured and loosened rock after the blast by sounding, and work of "barring down" same.

4. *Sketches and Drawings* : Make sketches to scale of the tools used,

including the details of the several parts of a machine drill, noting the use of each part. Note any special modifications of improvements made in the mine shops in the details of the drills, or in their separate parts. Make sketch of drill and column, showing method of setting up. Sketch scaffolding or any unusual method of support. Make sketch illustrating general system of attack, showing location of blasts necessary to "square up" the face. Make drawings to scale in three projections, showing accurately the actual position of several separate blast holes in a drift; in a shaft; in a stope; numbering the holes in the order of firing. Holes bored in the absence of the students should be indicated by dotted lines. Each blast hole may be located by noting its depth, and measuring, from some assumed point of reference, the coördinates of its mouth, and of its intersection with the bottom, top, or side of the level.

5. *Details of Contracts*: Inquire the number of feet driven or sunk, and the number of fathoms stoped in previous months, also average progress. Details of contracts, steel, powder, and other supplies consumed, etc. Number of men and their duties. Measuring of contract work at end of month.

## 2. TIMBERING.

1. Note the different purposes for which timbering is used underground, viz.: to support weak portions of hanging wall, either directly by stulls, or indirectly by means of lagging; to preserve arches and pillars of ground from being weakened by shelling off; to support excavations through loose or broken ground; to support the excavated rock in the stopes, thus furnishing indirectly a support for the men and machines in stoping; and finally to confine the waste rock filling the old workings, by which the walls of the mine are "kept abroad."

2. Observe methods of putting in a stall; the selection of suitable place for the head and foot of the timber, by inspection and "sounding"; cutting the hitch, and preparation for the head, and the number of men and tools required. The measuring and cutting the timber, including the shape of the head and foot, and how the proper angle for the head is obtained. Note method of cutting in case of a crooked stick. Note method of lowering timber into the mine, of handling it underground, and methods of arranging the tackle and hoisting the timber into place and securing it. Methods of staging, when this is necessary, to reach timber requiring renewal. Methods of replacing and reinforcing old and failing timber.

3. Inquire what kinds of timber are used, the relative value of different sorts, and whence obtained. Use of seasoned versus green timber, stripping of bark, etc. Life of timber and causes of deterioration.

4. Sketch and describe from actual examples the different forms of timbering used in the mine—stulls, crib-work, batteries, rearing, pentice, three-quarter and full sets, legs, caps, and sills, A sets, saddle-back stulls, wall-plates, studs, lagging, blocking, etc. Make small scale drawing of the timbering in a shaft and in the "gunniss" between two shafts, and from the top of one arch to the level below; showing the general arrangement of the shaft timber, including skip-road, dividing timbers, ladder-way, and sollars; and the timbering in the stopes, including the stall timbers over the level, the false stulls, if any, the travelling way, and the arch and pillars of rock. Note in each case the

manner of supporting the ends of timbers by hitches, by wedging, or by auxiliary timbers, iron bolts, or straps.

Sketch details of shaft timbering, showing methods of constructing skip-roads, the support of pumps, column-pipes, and pump-rods, details of ladder-way, timbering at and below a level, sollars and landing stage. Sketch and describe timbering of a vertical shaft, including details of framing of ordinary cribs, and bearing cribs, solid cribbing and prop-frame timbering, and methods of supporting pumps, column-pipes, and rods, and details of hoist-way, ladder-way, etc. Note occurrence of bearing stulls and stringing pieces.

### 3. HANDLING OF ROCK.

1. Observe methods of bringing rock from the stope to the level, and the loading of cars, noting sledging or block-holing for breaking large pieces, and the sorting of waste rock from copper rock. Describe the construction of tram-cars, with their dimensions, capacity, and weight. Note gauge of track, section and weight of rails, details of switches, etc. Describe work of trammers, noting time of loading, length of trip and time required, number of trips and amount trammed per day; note delays and their cause; describe dumping devices, and methods of transferring rock at different points; note methods of handling and disposal of waste rock underground and on the surface.

2. Describe hoisting engines, location with respect to shafts, dimensions, speed, steam pressure, valve motion, gearing, etc. Construction of drum, diameter and length of same, means of throwing in and out of gear, details of breaks, number of revolutions per minute, and time required to hoist from bottom. Wear of brakes and renewal of brake shoes. Size and character of wire rope and chain, and method of attaching the same to skips or buckets. Wear and breakage of ropes; tarring of ropes; splicing of breaks. Tell-tales and signals, position of each and use; speed of buckets, skips, and cars. Note the use of whims and whips for exploratory workings, and of hand windlass in sinking.

3. Describe methods of handling the rock at the surface, including method of dumping the skips; details of the automatic tramway, and method of operating the same; wear of rope and pulleys.

4. Sketch loading platforms, mills, chutes, pockets, etc. Tram-cars, skips, buckets; details of skip-way, and tram-road, including sheaves, guide-rollers, dumping devices, underground and on the surface, switches, turnouts, etc. Sketch details of automatic tramway. Sketch shaft-house, showing framing and bracing, support of hoisting pulleys, dumping devices, etc. Sketch different forms of trestle-work.

### 4. DRAINAGE.

1. Describe the general system of drainage, location of adits or drainage levels, size and grade of drainage ditches in the levels, construction and use of "guttering," location and general arrangement of sumps, forks, and cisterns, relative amount of water from the different levels, and from the different parts of the mine. Describe the general arrangement of the pumping plant, including details of pumping engine, diameter of cylinder and stroke, speed, steam pressure, valve motion and cut-off; construction of bobs, pump-rods and plunger,

and lift or jack-head pumps ; note manner of joining rods, and of connecting them to the bobs and to the pumps ; methods of balancing weights and changing direction of rods, number and location of balancing-bobs, angle-bobs, etc. ; the length of stroke and manner of altering same, the speed of pumps, their capacity and amount pumped per day. Describe construction of pumps, including details of plunger, piston, packing boxes, valves, and regulating devices ; construction of column-pipe, diameter and thickness, method of making joints, bends, and offsets, and of repairing leaks and breakages, repairs to rods, renewal of rollers and sheathing ; methods of packing different pumps, and of repairing valves. Ascertain amount of attention and labor required in caring for pumping plant, and frequency of packing and repairs, and by whom made. Note the occasional use of steam or compressed-air pumps, and the support and covering of steam pipes, and disposal of exhaust steam. Note use of buckets or water-cars for hoisting water, and application of syphons or bore holes in exceptional cases. Describe construction of dams, and the necessity for their use.

2. Sketch, on small scale, the general arrangement of the pumping plant, showing engine, bobs, pump-rods, pumps and sumps ; sketch details, on a larger scale, of lift, jack-head, and plunger pumps, including construction of valves, pistons, and packing boxes ; details of column-pipe, snore pieces, angles, H pieces, etc. ; details of bobs, method of joining, supporting, and guiding rods ; wings and catches, and method of attaching plunger-poles and lift-rods ; sketch methods of supporting pump-rods and column-pipes.

#### 5. EXPLOITATION.

1. Describe the general plan of working the deposit, including the development by sinking and drifting, and the method of starting and working the stops.

2. *Shafts* : Describe methods of sinking and raising shafts and winzes, including the method of attack, the plan for protecting men at their work, the hoisting of the rock by hand, or by special hoisting engines, the manner of transferring the line of the shaft, and of connecting the new section with the old ; note the methods of ventilating and draining the shaft while sinking : describe the method of attack in raising shafts, including construction of scaffold, support of drills, etc.

3. *Drifts* : Note the development of ground for stoping by means of drifts, the size and position of the drifts as determined by the character of the ore deposit, its thickness, and the distribution of the copper therein.

4. *Stopes* : Note manner of starting stopes from a winze or shaft or by raising from the level. Note the arrangement and method of working stopes, the number of stopes between the levels, the conditions limiting the height of the same, and the distance between levels. Note different methods of stoping employed, determined by the size and dip of the deposit, the character of the wall-rocks, and the relative proportion of barren rock and copper-rock having to be mined. Make sketch of stopes in longitudinal and cross section, showing method of stoping, and lines limiting different contracts, "drift-stopos," "back-stopos," etc.

5. Make longitudinal and cross sections of the mine, on a small scale, showing number, location, and distance apart of shafts and levels, and their present

depth, length, and the arrangement of stopes, and size and location of arches, pillars, and unworked ground, illustrating fully the present condition of the mine and the method of working. Show location of pumps, engines, compressors, boiler houses, rock-house, and line of steam, air, and water pipe, and indicate by arrows the course of the ventilating currents.

#### 6. SURFACE WORK.

1°. Make a sketch map showing the relative position of shaft-houses, hoisting-engine and pumping-engine houses, compressor house, boiler house, magazine, store-house, change-house, rock-house, dumps, tramways, railroad tracks, switches, turnouts, etc., roads, lines of steam, water, and air pipes, shops, offices, dwellings, and other buildings.

2°. *Shops* : Describe the arrangement of the different shops connected with the mine, viz.: blacksmith shop, machine shop, carpenter shop, and saw-mill, giving an inventory of the machine tools in each, and notes as to kind of work done. Make sketches giving plan of each shop.

3°. *Blacksmith Shop* : Describe method of sharpening and tempering bits of machine drills, moils, picks, etc. Describe any special tools used in shaping and sharpening drills. Note the time required for sharpening and tempering, and number of drills sharpened per day. Note arrangement of steel room and method of giving out steel, manner of marking tools and of separating those of different contractors.

4°. *Machine Shop* : Describe work of repairing rock drills, pumps, and other machinery. Note parts of drills most liable to wear and breakage, and the manner of failure. (See also under "Drilling and Blasting.")

5°. *Carpenter Shop* : Note the work of the carpenter shop ; making and repairing of ladders, tram-cars, and miscellaneous repairs.

6°. *Boilers* : Describe construction of boilers used, their setting, size, number, total horse-power, and pressure of steam. Note construction of grate, size of fire-box, use of feed-water heaters, feed-pumps, and injectors. Note kind of fuel used, and method of obtaining draft.

7°. *Engine-House* : Note arrangement of engine-house, and location with regard to shafts, construction of building and roof, precautions against fire. Give plan of building, showing locations of boilers, hoisting and pumping engines and compressors, and methods of connecting and gearing.

8°. *Compressors* : Describe air compressors used ; dimensions of steam and air cylinders ; details of valves ; pressure of steam and of air, and method of regulating same. Note method of cooling air, and temperature obtained ; size, construction, and number of air receivers ; diameter and length of air pipes ; methods of supporting pipe ; and distribution of air throughout the mine. Note purposes for which compressed air is used, and estimate, if possible, the total cost of compressed air, and proportion of cost chargeable to different machines.

9°. *Water Supply* : Note sources of supply for boilers and household use ; methods of purifying the same ; and additional sources of supply in times of drought.

10°. *Miners' Houses* : Describe miners' houses, construction, and arrange-

ment of rooms ; cost of building, and rent demanded ; total number of houses and total number of workmen accommodated. Sketches, showing framing and construction, and arrangement of rooms.

11°. *Change-House or Dry House* : Note arrangement and location of change-house, method of heating, facilities for washing, drying of clothes, arrangement of lockers, care and protection of building, precautions against fire, rules and regulations.

## 7. CONCENTRATION.

1°. *Rock House* : Describe the arrangement of the rock-house and the method of sorting and crushing the copper rock ; the construction of the gratings or screens ; the kind of bars used, their cross-section, inclination, distance apart, their wear and renewal, and efficiency of screening. Describe handling of copper rock, separation and disposal of waste rock ; construction of the jaw crushers, size of opening, number of machines, and arrangement with reference to the screens and to each other. Note repairs of crushers, and wear and breakage of jaw-plates. Describe drop or steam-hammer for breaking large pieces of rock, and methods of cleaning masses and barrel work. Note arrangement for picking fine rock, if any. Describe construction of ore-pockets, their size, capacity, and method of framing. Describe method of loading cars, including the handling of ore cars ; grade and arrangement of track ; the construction of the feeding chutes. Number of men employed, amount of rock treated, and amount of waste rock removed. Note dimensions and horse-power of engine and boiler, and size of pulleys and widths of belting used for distributing power. Sketch screens, drop hammers, crushers, pockets, chutes. Make sketches showing longitudinal view and cross-section of rock-house, and plans of different floors, showing the method of framing and arrangement of machinery, shafting, and belting.

2°. *Stamps* : Describe the steam stamps ; the size of steam cylinder ; pressure of steam and cut off ; length of stroke ; number of strokes per minute ; weight of stamp ; size and shape of screen openings ; method of feeding rock, of maintaining proper thickness under the stamp, and amounts stamped per day ; amount of water required. Make sketches showing construction of stamp, including foundations, the frame, mortar, screens, and lining ; stamp and stamp head ; and details of valve motion and rotation. Note manner of cleaning mortars and of making repairs, including renewal of screens, stamp shoes, etc. Note delays, length of time stamp remains idle, and cause.

Describe construction of drop stamps ; weight of stamp ; fall ; number of drops per minute. Sketches showing construction of mortar, including foundations, screens and dies ; shape of cam and tappet ; details of stamp stem, stamp head and shoe. Amount of rock crushed per day. Note wear of cams, tappets, shoes and dies, and method of renewing the same.

Describe other forms of crushing apparatus, including atmospheric stamps, Hodge grinder, Sturtevant mill, and note advantages or disadvantages as compared with steam stamps.

3°. *Classification* : Describe construction and operation of different forms of classifiers used. Size of discharge spigots. Note number of classes of sand

produced ; proportion of each class, range of size in each class, and methods of regulating same. Make sketches in plan and two sections showing construction of the different classifiers:

4°. *Jigging* : Describe construction and method of working the jig used. Note products of each jig, further treatment and disposition of same. Illustrate by diagram. Construction of jig-box ; piston ; and sieve ; and details of jig motion. Note length of stroke of different jigs and method of regulating same ; number of strokes per minute ; amount of sand and water passing over jig, and of water admitted below sieve ; method and frequency of skimming the jigs. Size of screen-mesh in each jig. Effect of stroke, speed, under-water, and other conditions on working of jigs. Irregular working, causes and remedy. Packing of sand on sieve. Irregular and uneven flow of water through sieve. Poor hutch-work. Rich tailings, etc. Make plan and longitudinal section of one set of jigs, showing arrangement of roughing jigs, finishers, and tail-finishers, classifiers, launders and copper-boxes, and indicate movement of different sands and concentrates. Sketch of jig in plan and cross-sections, showing construction, with sketch of details on larger scale.

5°. *Slime Treatment* : Describe the operation of the slime-tables and the methods of treating slimes ; construction and operation of slime-tanks, and method of feeding slime and wash-water to tables. Method of rotating table, and speed. Note effect of spiral shape of feeding apron ; amount of slime and of wash-water per minute ; and amount of solid material treated per day. Method of removing middlings and concentrates, and further treatment of the same. Note inclination of different tables. Make diagram showing treatment of slimes and middle products and concentrates. Describe other forms of slime-tables and details of their manner of working. Make sketches of slime-tanks, tables, and copper boxes, in plan and cross-section.

6°. *Auxiliary Apparatus* : Describe the working, and make sketches, of dolly tubs, square and round buddles, and other auxiliary apparatus. Describe in detail, from actual observation, one or more operations in each form of apparatus, kind and amount of material treated, and products made, and time required for each stage of the work. Give diagrams showing treatment of different middle products, and note the difficulties attending the concentration of such material.

7. *Tail-House* : Describe the operations of the tail-house. Note what material is treated therein, the object of such treatment, and the amount and character of the products obtained. Make diagram showing movement of material in tail-house, and sketches showing plan of tail-house and details of apparatus used.

8. *In General* : Describe construction of mill ; foundations, framing, and roof ; of floor ; the grade required ; arrangements for collecting overflow from different machines. Dimensions and grade of launders for conveying sands, slimes, concentrates, and waste products. Describe method of lighting the mill, including location and arrangement of windows, and provision for lighting at night. If electric lighting is used, give details as to number and size of lamps employed, location and method of hanging same, size and power of dynamo used, cost of installation, maintenance, and repairs. Describe kind of



boiler and engine used, dimensions and horse-power. Note source of water used in mill ; size, length, and grade of supply launder or ditch ; or the character, dimensions, speed, and capacity of the pumps. Additional sources of water supply in case of drought, and devices for economizing water and using water over again in case of necessity. Note precautions against fire. Describe method of barrelling the copper, including arrangements for drying the same, if any. Note the richness of the different grades of copper produced, whence obtained, and relative amount of each grade produced. Separation of silver. Describe arrangements for disposal of waste sands. Note methods of sampling waste sands and slimes and give results of assays of same. Note sources of loss in the treatment of copper rock, and methods employed for limiting the same. Details of engines and boilers, and distribution of power.

Make plan and sections of mill, showing details of framing and roof, method of lighting, arrangements of machinery, and shafting and belting, location of jigs and slime-tables, and arrangement of launders.

#### 8. TRANSPORTATION.

Describe the method of transportation from mine to mill by railroad, or self-acting plane. Note construction of railroad ; gauge of track ; weight and section of rails ; length of road ; ruling gradients with and against traffic ; radius of curves. Describe construction of cars, dimensions, capacity, and weight, running gear and dumping devices ; brakes and couplings ; total number of cars required. Give details of locomotives used ; weight ; diameter and number of drivers ; diameter of cylinders and stroke. Number of cars hauled per trip, and number of trips per day. Sketch of cars in plan and sections.

Describe construction of automatic plane ; length, grade, gauge of track, details of switches. Details of drum, or sheave, and brake, size and character of wire rope ; kind of rollers ; dimensions and distance apart ; life of rope ; method of loading and handling cars at top of plane, and of dumping at bottom. Signals and safety devices. Sketches of plane in plan and longitudinal section, and of details of drum or sheave, rollers, switches, cars, loading and dumping arrangements, safety devices, etc.

Note arrangements for handling supplies, machinery, mass and barrelled copper, docks, roads, etc.

#### 9. ORGANIZATION AND ADMINISTRATION.

Give a list of the officers of the company, in the different departments, with the duties of each. Give a list of the different kinds of workmen employed underground, on the surface, in the shops, rock-house, railroad, and mill. Note what work is by contract, and what by day labor. Describe methods of keeping accounts with men, including keeping of time-books, supply accounts, store accounts, making out of pay-roll, and payment of men. Give details of organization of relief clubs for the benefit of sick or disabled men, with relation of company to same.

HENRY S. MUNROE,  
*Adjunct Professor Practical Mining.*

As in previous years, the students were divided into squads of two men, and the squads were grouped in sections. Each section was under the immediate charge of the professor or one of his assistants, who went with the students to their place of work, and visited them there from time to time during the day. As in previous years, each squad was assigned some particular subject on the scheme of study each day, and were placed with a gang of skilled miners engaged in that kind of work. Each assistant had under his charge the squad studying a group of subjects. For example: Mr. Woolson had "drilling and blasting," and "exploitation," including drifting, sinking, and stoping, and the general arrangement of the underground workings; Mr. Ormsbee had charge of the squad studying "timbering" and "drainage"; Mr. Janeway had the superintendence of the underground surveys executed by the students; and the professor directed the work of those studying "concentration," "surface works," etc., while exercising at the same time a general supervision over the work of the whole class. A lecture was delivered each morning on some portion of the scheme of study, and at night the note-books of the students were examined and marked, mistakes corrected, and omissions pointed out. This daily examination and marking of the note-books has proved a most valuable innovation; the work of the students is made more thorough and complete, they are taught what to observe and how to record their observations, and the note-books are quickly filled with sketches and data of permanent value to them,—of value not only as illustrations of their lectures in the school, but also as containing suggestions of use to them in their future professional work. The detailed study of the Atlantic Mine, as indicated by the scheme, extended over five weeks,—a much longer time than heretofore devoted to this part of the work of the Summer Class. This was due to the greater thoroughness with which the work was done this year, which was made possible by the better organization of the force of instructors, and by the greater interest the class took in their work, living as they did at the mine, and

in closer contact with the mining operations. Not only did the work last more weeks, but more time was spent by the students each day in profitable study, so that the class accomplished much more than usual in the same time. The extra time spent in this detailed study was taken from that usually devoted to excursions and visits to other mines. These excursions by the class in a body, while exceedingly interesting, have always proved less profitable than the more deliberate and careful study of details by the students singly or in small squads. So that the change of the plan of work this summer is, I think, in the right direction.

But one excursion was attempted this year. During the sixth week one day was devoted to a trip to the mines of Keweenaw County. By starting very early and prolonging the trip till midnight sufficient time was secured to visit the Copper Falls and the Central mines. A tug was chartered at Houghton, and the trip was made by water as far as Eagle Harbor, at which place we were met by teams, which took the party to the Central Mine. This mine is one of the few still worked for mass copper, and is one of the deepest in the copper region. The students spent several hours underground, going down and coming up on the "man-engine," visiting the principal workings where they saw some large masses of copper being cut into blocks of a size that could be handled, and had the opportunity of studying a method of mining radically different from the system followed in the Atlantic Mine. On the way back to Eagle Harbor we visited the Copper Falls Mine. Part of the class went underground, making the trip through a tunnel about a mile long, in cars drawn by a locomotive. The rest of the students spent their time in the mill.

The sixth week the class was divided into small parties to visit different mines in the copper and iron region, each student being assigned some special subject for study and observation, the notes collected by him on this subject to be incorporated in his summer memoir. The students were sent to the following mines, with subjects of study as noted :

Mine.	Subject.	Student.
Central Mine, Keweenaw Co., Mich.	Methods of Mining	H. P. Nichols.
" " " " "	Timbering . . . .	G. F. D. Trask.
" " " " "	Man Engine . . . .	F. Mc. M. Stanton.
" " " " "	Pumps . . . . .	J. A. Staunton Jr.
Copper Falls Mine, Keweenaw Co., Mich.	Methods of Mining	J. L. Warner.
Osceola and Tamarach Mines, Houghton Co., Mich.	Methods of Mining	F. M. Simonds.
Osceola and Tamarach Mines, Houghton Co., Mich.	Hoisting Plant . .	C. C. Restrepo.
Osceola and Tamarach Mines, Houghton Co., Mich.	Timbering . . . .	J. R. Bien.
Osceola and Tamarach Mines, Houghton Co., Mich.	Concentration . . .	W. C. Butler.
Osceola and Tamarach Mines, Houghton Co., Mich.	Concentration . . .	J. S. Cox, Jr.
Quincy Mine, Houghton Co., Mich.	Methods of Mining	E. D. Church.
" " " " "	Man Engine . . . .	H. M. Cole.
Huron Mine, Houghton Co., Mich.	Concentration . . .	L. H. Rytherford.
" " " " "	Methods of Mining	G. S. Rice Jr.
Champion Mine, Marquette Co., Mich.	Method of Mining	P. O. Wels.
Michigamme Mine, Marquette Co., Mich.	Method of Mining	F. W. Tower.
Republic Mine, Marquette Co., Mich.	Method of Mining	R. Lahey.
Republic Mine, Marquette Co., Mich.	Air-compressing Plant	J. Lahey.
Vulcan and Chapin Mines, Menominee Iron Region . . . . .	Method of Mining	A. L. Burns.
Vulcan and Chapin Mines, Menominee Iron Region . . . . .	Timbering . . . .	J. R. Marsh.
Hibernia Iron Mines, Essex Co., N. J.	Method of Mining	D. C. Adams.
Richards Mine, Essex Co., N. J.	Method of Mining	H. C. Mannheim.
Durham Iron Mine, Durham Co., N. J.	Method of Mining	W. H. Aldridge.

For the summer memoir each student was required to elaborate a part of his notes taken at the Atlantic Mine, on one or more of the subjects of the scheme of study as assigned him; and to incorporate notes taken at other mines in the special subject given in the above table.

In concluding, I must acknowledge the uniform courtesy of the mine officers at the mines mentioned in this report, in connection with the students' work. Everywhere great interest is shown in the objects of the Summer School, and every possible assistance given to the students and to their instructors. Our thanks are due to the officers and men of the Atlantic Mine especially, at which mine we made so

long a stay, and where previous classes have in past years enjoyed the same hospitality that was accorded to us this year. It is certainly most encouraging to find that the students are not looked upon as a nuisance, but rather as welcome guests, and that wherever we go we are urged to come again. Both officers and men take pride and pleasure in playing the part of instructors, and the more earnest and inquiring the student the better they are pleased. It is fortunate that this is the case; were it otherwise we should find our field of operations narrowing year by year, until finally the Summer School would have to be abandoned, or we should be forced to dig a mine of our own, as has been done at the School of Mines in St. Petersburg. Judging from the experience of the past ten years, it will be a long time before we shall be forced to this alternative.

Respectfully submitted,

HENRY S. MUNROE,

*Adj. Prof. of Practical Mining, etc.*

Columbia College, May 15, 1887.

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## II—SUMMER CLASS IN SURVEYING.

*To the President of Columbia College :*

I respectfully transmit herewith the Report of Adjunct Professor H. S. Munroe, on the Summer School of Surveying, held during the last vacation.

The students occupied the barracks provided by themselves (to which reference was made in a letter addressed to you recently) on the shores of Bantam Lake near Litchfield, Conn. Board was obtained at the Island Hotel near at hand.

It gives me great pleasure to state that the arrangements thus made, and the addition of a permanent assistant in the School of Mines, Mr. Mayer, as one of the instructors, have resulted in a thorough perfecting of all the details of this Summer School, and I believe no better opportunities for instruction in surveying are afforded in any school in the

world than are now presented to the students of the School of Mines. The practical character of the work leads the students to take great interest in it, and their time is fully occupied.

As an evidence of their good behavior, I may state that the proprietor of the hotel and the citizens generally spoke of the students in this respect in terms of the highest praise.

I respectfully refer to Prof. Munroe's report for a detailed account of the work.

Respectfully submitted,

W. P. TROWBRIDGE,

*Professor of Engineering.*

Columbia College, May 16, 1887.

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### REPORT.

*To Prof. Wm. P. Trowbridge :*

DEAR SIR : I have the honor to make the following report on the third session of the Summer School of Surveying, held at Bantam Lake, Litchfield Co., Conn., during six weeks in August and September of last year.

Mr. Ralph E. Mayer, Assistant in Drawing, who was last year appointed also Assistant in Surveying, and Messrs. L. H. Rutherford and A. Stevens of the present fourth class served as the assistants for this summer session, and proved not only well qualified for the work, but zealous and painstaking as well.

The following students attended the sessions of the Summer School as required by statute :

D. C. Adams,  
E. Agramonte,  
F. Bartlett,  
C. E. Beckwith,  
H. P. Bellinger,  
Geo. Berry,  
J. R. Bien,  
E. D. Church,  
C. N. Comstock,

K. E. Eilers,  
W. D. Gardner,  
A. Hawkesworth,  
O. B. Hebert,  
F. E. Hopke,  
J. J. Koen,  
J. Lahey,  
R. Lahey,  
H. Lipps,

H. S. Mackaye,	G. S. Rice,
J. Maclay,	G. Rowland,
R. P. Miller,	C. H. Schuman,
H. P. Nichols,	F. M. Simonds,
L. H. Norton,	F. McM. Stanton,
O. B. Parker,	J. A. Staunton,
H. Parsons,	D. N. B. Sturgis,
G. S. Percival,	R. H. Syms,
A. L. Pittinger,	J. B. Taylor,
A. M. Poole,	E. Van Volkenberg,
H. Reckhart,	E. F. Weekes,
C. C. Restrepo,	Total, 41 men.

In addition to the above, eight men of the second class were debarred from attendance, under the rule excluding conditioned men. Of the men so debarred but one has been able to go on with his class, six are repeating the second-year studies, and one has left the school. One student without conditions, and four conditioned men who had received permission to attend the Summer School, absented themselves without explanation. Fifteen conditioned men were given permission to attend the Summer School; of these four absented themselves as noted above; four were excused at the end of two weeks, and two at the end of the third week, in order to give them an opportunity to make up their conditions; and five only out of the fifteen remained until they had completed their field work. Fifteen students of the present fourth class attended the summer class to make up deficiencies. Of these, three were men who had not reported themselves the year before, and six were students who had been excused before the end of the session to make up conditions. As the number of levels and transits and other instruments is not large enough for the whole class, there is a certain advantage to be derived from the irregularities in attendance above noted. The "repeaters," who have had more or less instruction in surveying the previous year, are at once put upon advanced work, and utilize the transits, etc., before they are needed by the regular class. These irregular students, however,

complicate the work of instruction not a little, and when a sufficient number of instruments shall have been procured, it will be necessary to check these irregularities by some special legislation compelling attendance at the proper time.

But few changes were made in the course of instruction, or in the work required of the students. The topographical survey by the rectangular method, with compass and hand-level, was omitted, and more time was given to the pacing survey, which was made to include more topographical work than heretofore.

Some interesting data were collected on the average length of the natural pace under different circumstances, and upon the degree of accuracy attainable in measurement by pacing. The length of the natural pace of twenty-nine men (average age perhaps twenty years), varied from two feet and six inches to three feet three inches. The distance paced was two hundred feet, which was paced ten times by each man. The average natural pace of twenty-nine men on level ground was 2.77 feet.

Similar tests were made on gently rising ground, and on a steep slope, the distance and consequently the length of the pace being measured horizontally. In pacing up the gentle slope, seven men lengthened their natural pace from one to eight per cent., four men retained the same length of pace as on level ground, and eighteen men shortened their pace from one to ten per cent. The average pace of the twenty-nine men was 2.72 feet, or about one and eight-tenths per cent. shorter than on level ground. Pacing up the steeper slope, two men lengthened their pace about five and ten per cent. respectively, two men maintained their natural pace, and twenty-five men shortened their pace from four to sixteen per cent. The average pace of the twenty-nine men was 2.58 feet, or about seven per cent. shorter than upon level ground, horizontal length of the pace being taken in each case as above noted.

In pacing down hill on the gentle slope, thirteen men lengthened their natural pace from two to nine per cent.,



seven men maintained their natural pace, and nine men shortened their pace two to fourteen per cent. The average pace of the twenty-nine men in this case was 2.78 feet, or about the same as on level ground. In pacing down the steeper slope, thirteen men shortened their pace two to twelve per cent., seven men maintained their natural pace as on level ground, and nine men lengthened their pace three to twenty per cent. The average paces of the twenty-nine men was 2.78 feet, or about the same as on level ground due to the fact that the short paces of some of the men were balanced by the longer paces of others.

It will be seen from these results, that the natural pace is not sufficiently accurate for surveying purposes. The students are therefore required to practise with an artificial pace until they can maintain a uniform length of pace on level ground, and up and down hill. The best results are obtained with a pace a somewhat shorter than the natural one, and for most persons 2.5 feet, the military pace, answers very well. Twenty-four of the students adopted this length, two, a length of 2.7 feet, and three took 3.0 feet for their artificial pace. After a sufficient amount of practice, each student was required to pace the sides of a number of triangles, forming the skeleton of a topographical survey; each student had twenty-seven such lines to measure, the true distances being unknown to him. Taking five students at random: A determined more than half of these distances within one per cent., and in three cases only did his error exceed two per cent.; maximum error, three per cent.; average error, 1.1 per cent. B determined one third of the distances within one per cent., and one third between one and two per cent.; maximum error, seven per cent.; average error, 2.1 per cent. C did not do as well, two thirds of errors exceeding two per cent.; maximum error, eleven per cent.; average error, 3.3 per cent. D determined about half the distances within one per cent., and about one-third exceeded two per cent.; maximum error, seven and a half per cent.; average error, 1.8 per cent. E determined three fourths of the lines within one per cent., and in only

three cases did his error exceed two per cent.; maximum error, three per cent.; average error, one per cent. Average errors of the five men 1.86 per cent. Distances measured 100 to 300 feet. Average distance, 184 feet.

The above results are interesting as showing what can be done after a few hours' practice. With more experience the errors should rarely exceed two per cent., and the average error should not be over one per cent. This is sufficiently accurate for most reconnoissance work, and for the detail work in topographical surveys, provided that the pacing be checked at intervals by instrumental work. The errors in chaining, if the chain-carriers are inexperienced or careless, may easily exceed these limits.

Considerable time is devoted to surveys of this class without instrument, or with simple instruments only. Such surveys are executed rapidly, so that in the shortest possible time the student gains much practical experience in the rudiments of surveying, and becomes familiar with the methods of determining lines and points most useful in the field; the use of diagonals, tie-lines, range lines, and offsets. Apart from the educational value of these surveys, as an introduction to more refined methods, it is of the utmost importance that an engineer should be able to execute reconnoissance surveys rapidly and cheaply; and that in his instrumental surveys he should be able to locate less important details without resorting to the chain or tape.

The amount of field work accomplished by a body of forty or fifty students well equipped with instruments, is very great; and were it possible to utilize this work, large areas might be surveyed and mapped each year. This would necessitate, however, the distribution of the surveying squads over considerable area, and would make efficient supervision of the work impossible with the present force of instructors. Again it would be necessary for the instructors to spend much of their time in the work of organizing these large surveys, and they could not spend as much time in instruction as at present. And finally it would be impossible to check the accuracy of the work as promptly as desirable.

For these reasons it is not attempted to utilize the work of the students, but rather to make their field work educational; and to give them, so far as the time permits, thorough drilling in surveying methods and in the proper use of instruments. By a very complete system of checks any inaccuracy in the student's work is promptly detected, and careless work or improper methods can be corrected before it is too late. The different squads are concentrated in small areas, and their surveys follow parallel lines, or cross and recross each other, or occupy common stations and lines, so that to a certain extent they check each other. By this concentration of the work the supervision and instruction is made more effective.

The plane-table sheets, however, cover several square miles, and data have been obtained by which they can be combined and plotted on a single sheet. This will furnish a very complete map of Bantam Lake and vicinity, which can be extended from year to year.

Respectfully submitted,

HENRY S. MUNROE,

*Adj. Prof. of Surveying, etc.*

Columbia College, May 15, 1887.

### III.—SUMMER CLASS IN MECHANICAL ENGINEERING.

*To the President of Columbia College :*

I respectfully transmit herewith the report of Adjunct Professor F. R. Hutton on the operations of the Summer School in Mechanical Engineering (voluntary and optional) for the vacation following the commencement of 1886.

While there is little to be said of this summer instruction of Professor Hutton, which would not be mere repetition of what I have had the honor to lay before you heretofore, it is encouraging to find that there is no lack of interest on the part of the students in the exercises, although they were optional. Nor is there any falling off in the quality of the instruction, although this is voluntary on the part of Mr.

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Hutton. I hope at some future time this Summer School may be placed on a somewhat more permanent basis as a part of the regular course for certain classes of students.

Respectfully submitted,

W. P. TROWBRIDGE,

*Professor of Engineering.*

Columbia College, May 17, 1887.

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REPORT.

*To Prof. W. P. Trowbridge :*

I have the honor to submit herewith a report of the ninth year's Summer Class in Mechanical Engineering in the Shops.

The class were able to assemble on the morning of the first day of June, and disbanded at the close of the eighteenth day. The labor was thus condensed into fewer days than in the earlier beginnings of the class, in order that as much of the vacation might be left available for rest and recreation as possible before the students were compelled to begin work with the Summer Class in Surveying in August. It is unfortunate that it should be necessary to call upon the students to learn so much of new matters in so short a time, as they must fail to assimilate much which is brought to their notice. An ideal allotment of time would admit of a longer stay at the works, with less pressure exerted on each day.

The same choice of works was made as in the last two years, the courtesy of Messrs. C. H. Delamater and Co. of West 13th St. and North River, permitting us to make their works our head-quarters. No attempt was made to visit other works than these in the short time available, which was again a sacrifice in breadth of instruction, but was made in the interest of thoroughness in what was actually attempted. The class assembled in the morning for a preliminary "quiz" and discussion of what they were to study that day, and then separated for individual observation of

it. Their note-books with sketches should be a fund of practical information from which they should be able to draw, not only in their student life but perhaps even thereafter. The uncertainties in the outlook for business in view of labor complications had reacted seriously upon our hosts, and there was less pressure of work than in some former years. The students had a chance, however, to see some large casting and some large boiler-work. The contract labor also upon small pumping-machinery to be run by hot-air was also not affected, and was well-studied. There was also some marine work in progress.

The class this year again was smaller, in view of the obligatory work to come later in the same summer. It was not necessary to make use of the competitive method at all, to keep the number within the prescribed twenty, and men were admitted who were hampered all the while by labor to make up "conditions" in examination. A roll of the class and the syllabus of study is appended to this report.

It is scarcely necessary to repeat again the objects and methods of our work, experience in previous years having shown the most practicable way and the study being each year directed to the same end. It will be enough to say that it is sought to give the students as much information and training as possible for their duties as *supervisors* or *superintendents of the work of others*, without any attempt to give them the manual dexterity to do the work themselves. The course of study is directed specially to this end, while much of other utility is absorbed by the way. It may be objected that no one can properly supervise an operation which he cannot himself perform or which he has not himself once helped to do. While not assuming to deny the existence of such an objection, yet, so far as criticism of any work is concerned, it is admitted that a good critic need not be as eminent a specialist as the author of the work under review. And the mechanic of to-day is eminently a specialist, as a result of the principle of division of labor. Moreover, in the second place, the time available

in the training (both general and special) of our young engineers would preclude their acquiring manual skill in tool-handling during the four years of their school course, unless to the prejudice of other work which is considered of paramount importance.

This is, of course, particularly the case when, as at present, the young men are to be graduated with a degree of Civil or Mining Engineer.

The outline of study and a roll of the class are appended.

Respectfully submitted,

F. R. HUTTON,

*Adj. Prof. Mechanical Engineering, School of Mines.*

Columbia College, May 15, 1887.

## MECHANICAL ENGINEERING.

SUMMER CLASS.

SCHOOL OF MINES, COLUMBIA COLLEGE.

### OUTFIT REQUIRED.

One pair outside calipers (4 inches).  
One brass-bound rule (2 feet) graduated to  $\frac{1}{16}$  inch.  
One pair blue drilling overall pants.  
One note-book (3 x 6 inches or over).  
Three-inch pencil-point dividers.  
Pencils and rubber.  
One lunch-box (folding preferable).

### PLAN OF STUDY.

Each student will attend with note-book at the appointed shop, from nine to four.

He will study closely and critically the machinery, tool, or process which has been for that day the topic of the clinical lecture by the instructor, taking full notes and illustrating them with free-hand sketches, with DIMENSIONS IN ALL CASES. Where the object is inaccessible (*e. g.*, roof-trusses) estimate dimensions by eye, and write "approx." under the title.

Students will also seize every opportunity to draw and describe all details of engines and machinery in process of construction which are accessible to measurement. Such are—boilers, pistons, cross-heads, cranks, pillow-blocks, valves, wheel-arms, connecting-rods, eccentrics, stubs, governors, walking-beams, gallows-frames, propellers, paddle-wheels, and such engine castings as valve-chambers, cylinders, bed-plates, etc.

These notes and sketches are to be worked up into a descriptive illustrated memoir, which must be handed in on or before the first Monday of October.

### OUTLINE OF COURSE OF STUDY.

#### I. GENERAL PLAN,

Prepare a ground plan of the plant (dimensions by paces): prepare also ground plans of each shop, showing position of each tool in it.

**2. TRAVELLING CRANES.**

Support of rails ; trussing of crane-girders ; span ; speed of lift and of travel ; speed of driving-rope ; capacity ; gearing and tackle used ; proportions of parts ; method of driving and controlling crab.

**PIVOT CRANES.**

Location ; span ; height ; bracing ; foundation ; structure and movement of buggy ; hoisting-gear ; capacity and speed of lift ; men required. Power cranes.

**HOIST AND TACKLING.**

Situation ; dimensions ; capacity ; construction ; handling.

**TELEGRAPHS.****3. PRINCIPLES OF ARRANGEMENT.**

Study these for the whole plant with respect to :

- (1) Transmission of power.
- (2) Progress of work through the shops.
- (3) Superintendence.
- (4) Ease of shipment of goods.

**4. STRUCTURE OF BUILDINGS.**

Study with respect to :

- (1) Solidity to uphold shafting, etc.
- (2) Foundations and roof-trusses.
- (3) Combustibility in case of fire.
- (4) Windows, lighting, and ventilation.
- (5) Convenient arrangement of tools.

**5. BOILERS.**

Study position of boilers with respect to :

- (1) Coaling and removal of ashes.
- (2) Delivery of smoke.
- (3) Condensation of steam.
- (4) Danger from fire and explosion.
- (5) Superintendence.

Describe the boilers ; how set ; size and height of chimney ; diameter and length of steam-pipe ; joints ; support ; lagging. Feed-pipe ; feed-heater ; blow-off pipe ; sizes ; valves and apparatus. Gauges. Pressures. Boilers over heating furnaces.

**6. ENGINES.**

Study position of these with respect to :

- (1) Distribution of power.
- (2) Ease of attendance, etc.

Note their speed ; sizes of cylinders ; mechanism ; fly-wheel ; exhaust-pipe ; condensers ; governors.



## 7. DISTRIBUTION OF POWER.

Sizes, speeds of main belt ; sizes of main pulleys ; sizes, speeds, and location of main shafts ; couplings ; hangers, forms, intervals, and lubrication.

Motion to shafts at angles ; use and structure of countershafts.

*Pulleys* : Sizes, faces, arms, securing, oiling.

*Belts* : Kinds, sizes, speeds, lacings, shifters, tighteners, open and crossed.

*Other transmissions.*

## 8. CARPENTER AND PATTERN SHOP.

Study wood-working machine-tools.

*Saws* : Slitting, cross-cut, band, and jig. *Lathes.*

*Planers* : Bed, carriage. *Matchers.*

Speeds and capacities of each.

Study hand-tools—what are they and how used.

Shrink-rules ; glues and varnishes and their preparation.

Division of patterns, dowels, core-prints and core-boxes, draught.

Draw-irons, storage of patterns.

Expense of patterns.

## 9. IRON FOUNDRY.

Size, shape, structure, foundations, lining of cupolas.

Capacity, charging, mixtures, starting fires, tapping, dropping out.

Blast, pressure, how introduced, kind of blower.

*Ladles* : Form, size, structure, handles, tipping-gear.

*Sands* : Green, dry, facings, core-material, forming and baking. Washes.

*Flasks* : Cope, drag or nowell, loam-casting, sweeps, core-lathe, cleaning castings, rumbles.

Study processes of mouldings, forming gates and supporting cores.

Study processes of casting, skimming, avoiding shrinkage strains and explosions.

Note time necessary and economy of close casting.

BRASS FOUNDRY : Alloys, moulds, furnaces, and crucibles.

## 10. FORGING.

HEAVY : Furnaces, hammers, anvils, and foundations.

Cranes : Blast.

How large forging is built up and completed. Time required. Upsetting, cutting off.

LIGHT : Forges, kinds of fuel and fires, blast.

*Hammers* : Steam and power.

*Hand-tools* : Sledges, hammers, anvils, tongs, swages, chisels, flatters, fullers.

*Processes* : Heating, upsetting, scarfing, welding, fluxes.

Tongue, scarf and butt welds. Drawing down, bending, cutting-off, punching and its limits.

Tempering and forging of steel.

Flanging of plate—anvils, mauls, vises, fires, etc.

Economy from close forging.

COPPER SHOP: Brazing, galvanizing, spinning, peining, babbitting.

#### 11. BOILER SHOP.

Shearing, beveling, marking, punching, drilling, boring, bending.

Riveting, by hand and machine, drifting, reaming, calking, expanding tubes, cutting off and heading over.

Times required per foot.

#### 12. METAL-WORKING MACHINE TOOLS.

Lathes—Drills—Vertical lathes and boring machines.

Planers—Sharpers—Slotters—Milling machines.

Emery wheels and grindstones.

Study:

(1) Motions of tool and work. How produced. Back-gear, cone-pulleys, quick returns. Rpm and speed.

(2) Centring and chucking. Time required. Forms of chucks, face-plates, dogs, and drivers.

(3) Cutters—Forms, temper, cutting edges, spring, nature and weight of chips, poor forms. Rotary cutters.

(4) Tool-rests and holders—Motions, methods and directions of feed, depth of cut, time to finish one square foot.

Roughing and finishing cut. Water finish.

#### 13. BENCH WORK.

Hammers—Chipping by cold and cape chisels.

Files—Bastard, smooth, dead smooth, second-cut, safe-edges—Sections, draw-filing. Grinding, scraping, marking, surfacing. Tapping and pipe-fitting by hand and machine.

#### 14. FLOOR WORK.

Ratchet, hand and breast drills; fly and twist drills.

Boring bars and mills. Extensible and flexible shafting.

Socket nuts, wrenches.

#### 15.

Supply-room. Tool-room. Contents and system.

#### 16.

Drawing-room and office. Equipment and labor.

Accounts—Time-keeping—Paying—Shop rules.

Labor system—Men and helpers—Laborers. Superintendence.

Number of men employed in each division. Economy of labor account.

F. R. HUTTON,

*Instructor Mechanical Engineering,  
School of Mines.*

ROLL OF THE CLASS.

F. Bartlett, C. N. Comstock, E. M. Decker, W. Fisher, E. Gould, A. Hawkersworth, O. B. Hibert, F. E. Hopke, H. Lipps, J. Macclay, R. P. Miller, O. B. Parker, H. Parsons, G. S. Percival, R. H. Syms, E. Van Volkenberg, D. W. Ward.

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IV.—REPORT ON SUMMER CLASS IN PRACTICAL GEODESY.

*To the President of Columbia College :*

I have the honor to submit herewith my report on the Summer School in Practical Geodesy.

The class began work on June 1, 1886, at the observatory. On June 15th the class assembled at Cooperstown, N. Y., where the field work was accomplished. The class was dismissed July 10th. The following was the scheme of work proposed :

OUTLINE OF WORK REQUIRED.

- I.—1. Values of level divisions obtained by means of the "level trier."  
 2. Conversion of mean time into sidereal time, and *vice versa*.  
 3. Arrangement of star catalogues and methods of calculating apparent places from the mean places.  
 4. Use of the Almanac for calculating elements needed in reductions.
- II.—Transit Instrument, Clock and Chronograph.  
 1. Construction.  
 2. Theory of instruments.  
 3. Adjustments.  
 4. Star lists and tables.  
 5. Observations and reductions for constants and time error of clock.
- III.—Zenith Telescope for Latitude.  
 1. Construction.  
 2. Theory of the instrument.  
 3. Adjustments.  
 4. Determination of constants.  
 5. Star lists.  
 6. Observations and reductions.
- IV.—Equatorial Telescope.  
 1. Construction.  
 2. General theory of instrument.  
 3. General method of making observations.
- V.—Sextant.  
 1. Construction of the instrument.

2. Theory of instrument.
3. Adjustments.
4. Use: (a) Angle-Measuring.
  - (b) Time by single altitudes of sun, employing artificial horizon.
  - (c) Time by equal altitudes of the sun—(art. hor.)
  - (d) Latitude by single altitudes of Polaris (art. hor.)
  - (e) Latitude by circummeridian altitudes of the sun or stars (art. hor.).
  - (f) Time by altitudes of stars.
- VI.—Base-Measuring.
  1. Construction of apparatus.
  2. Adjustments.
  3. Measurement of a base and reduction of observations.
- VII.—Angle-Measuring by "Repetitions."
  1. Construction of instruments.
  2. Adjustments.
  3. Observations and reductions.
- VIII.—Angle-Measuring by "Directions."
  1. Construction of instruments.
  2. Adjustments.
  3. Observations and reductions.
  4. Night observations.
- IX.—Determination of the True Meridian, and the Azimuth of a Line.
  1. Theory of methods.
  2. Observations and reductions.
- X.—Execution of a Triangulation and Reduction of Results Obtained.
- XI.—Trigonometric Leveling.
  1. Theory of methods.
  2. Observations and reductions.
- XII.—Barometric Hypsometry.
  1. Construction of instruments.
  2. Adjustments.
  3. Formulæ and tables.
  4. Observations and reductions.

This scheme was not fully accomplished. The subjects marked I. 3; III. 1, 2, 3, 4, 5, 6; IV. 1, 2, 3; VIII. 4; IX. 1, 2, were dealt with mainly by lectures in the observatory or in the field. By spending this year more time in the observatory we hope to cover all the ground indicated in the scheme. I was assisted in the observatory by Mr. E. L. Stabler, Fellow in Science, and in the field for a short time, by L. H. Jacoby, then Fellow in Science.

I submit with my report the memoirs of the students on the following subjects:

Descriptions with drawings, after personal use,

- (a) Transit in observatory, sidereal clock, chronograph.
- (b) Base apparatus.
- (c) Direction instrument with micrometer-microscopes.
- (d) Mountain barometer.

The class numbered fourteen.

Respectfully submitted,

J. K. REES,

*Professor of Geodesy and Practical Astronomy.*

Columbia College, May 9, 1887.



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PRES

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ANNUAL REPORT  
OF THE  
PRESIDENT OF COLUMBIA COLLEGE  
FOR THE YEAR 1887-88  
MADE TO THE  
BOARD OF TRUSTEES,  
MAY 7, 1888



NEW YORK  
PRINTED FOR THE COLLEGE  
1888







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Press of  
**G. P. PUTNAM'S SONS**  
New York

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## PRESIDENT'S REPORT.

---

TO THE TRUSTEES OF COLUMBIA COLLEGE :

The annual report of the President for the academic year ending June 13, 1888, is herewith respectfully submitted.

Examinations for admission were commenced in the School of Arts on Monday, the 31st of May, 1887, and continued through the week, and examinations for admission to the School of Mines on June 3d. These examinations were resumed and completed on Monday, September 24th. Examinations in the School of Law took place on Saturday, September 29th.

Scholastic exercises were regularly resumed on Monday, October 3d, in all departments. Three of the professors were not present, being temporarily detained in returning. In two of these instances the delay was occasioned by failure to arrive in season by ship from Europe. In the other instance an officer who was engaged in scientific exploration upon the western plains was subjected to an unexpected delay of several days in prosecuting researches in palæontology.

*Appointments.*—The chair of Latin, which became vacant with the decease of Professor Short in December, 1886, has continued to be unsupplied through-

out nearly the entire year. Mr. Harry T. Peck, Tutor in Latin, has occupied the position *ad interim*, and has discharged its duties very acceptably.

Messrs. R. I. Allen, D. K. Dodge, W. A. Dunning, and T. S. Fiske, Fellows of the College, whose terms of service ended in July, 1887, were re-appointed for an additional year. The President of the College was authorized also to appoint three Fellows in place of N. M. Butler, W. C. Spencer, and H. J. Walther, whose terms of service expired in July, 1887. Under this authority were appointed Messrs. James C. Egbert, Edward A. Wasson, and Maurice G. Gennert.

Harry A. Short, at present Fellow in Latin, was appointed Tutor in that department for one year.

Frank J. Goodnow, Instructor in History in the School of Arts and Adjunct Professor of Administrative Law in the School of Political Science, whose term of service expired in July, 1887, was re-appointed to the same position in those schools respectively, to hold office during the pleasure of the board.

George H. Gilman, of the class of 1887, was appointed a Prize Fellow in Science.

Charles Knapp was appointed Prize Fellow in Letters.

In the School of Mines, James L. Greenleaf was appointed Instructor in Engineering and Drawing; Charles E. Colby, Instructor in Organic Chemistry; and Ferdinand G. Wiechmann, Instructor in Chemical, Philosophy and Chemical Physics.

Mr. A. D. F. Hamlin, who has served as an Assistant in the department of Architecture for several years past, was promoted to the grade of permanent



Instructor, for the term of one year in the same department.

Mr. F. D. Sherman was appointed Fellow in Science, attached to the department of Architecture, also for the term of one year.

Ira H. Woolsen was re-appointed Assistant in Drawing.

Henry C. Bowen, Fellow in Chemistry, was re-appointed Assistant in Quantitative Analysis, and Herman T. Vulté, Fellow in Chemistry, was re-appointed Assistant in Qualitative Analysis.

Joseph Struthers, Jr., was re-appointed Fellow in Mineralogy; Frederick J. H. Merrill, Fellow in Geology; Henry H. Porter, Fellow in Geology; and William H. Stuart, Fellow in Engineering.

Alexis A. Julien, Instructor in Biology and Microscopy, whose term of service expired October 1st, 1887, was re-appointed to the same position.

Alfred L. Beebe was appointed Fellow, Assistant in Assaying, in place of Charles F. Lacombe, whose term of service expired October 1st, 1887.

John Krom Rees, Professor of Geodesy and Practical Astronomy, whose term of service expired July 1, 1887, was re-appointed to the same position, to hold office during the pleasure of the Board.

Benjamin F. Lee, Professor of Real Estate and Equity Jurisprudence, whose term of service expired October 1, 1887, was re-appointed to the same position.

Alfred Gandy Reeves, a member of the graduating class of the Law School, was appointed Prize Tutor, in place of Charles E. Hughes, whose term of service expired July, 1887.

Holbrook F. J. Porter, Superintendent of Buildings, whose term of service expired in July, 1887, was re-appointed to the same position, to hold it during the pleasure of the Board.

Stephen R. Weeks, whose term of office as Proctor expired in July, 1887, was re-appointed to the same position, to hold office during the pleasure of the Board.

William A. Dunning was elected Prize Lecturer in the School of Political Science, to hold office for three years from July 1, 1887.

Richard J. H. Gottheil was elected to the Temple Emanuel Chair of Rabbinical Literature, to hold office during the pleasure of the Board.

C. B. Laraway was appointed Assistant in Natural History, in place of E. L. Petersen, deceased.

Frederick W. Whitridge was appointed Lecturer on the Constitutional and Political History of New York, to hold office during the pleasure of the Board.

The following members of the School of Political Science were appointed to the Seligman Fellowships for the current year: Paul K. Ames, Adolph Bierck, Jr., Percy S. Dudley, T. Gold Frost, and Elmer G. Sammis.

Michael Pupin, John Tyndall Fellow in Science, whose term of office expired December 31, 1887, was re-appointed to the Fellowship for an additional year.

John J. Northrup was appointed Fellow in Science, to assist in the department of Geology, in place of Henry H. Porter, resigned.

Edwin R. A. Seligman was appointed Adjunct Professor of Political Economy in the School of

Political Science, to hold office for three years, or during the pleasure of the Board.

At the meeting of the 9th January, 1888, it was resolved that there be established in the School of Arts the grade of Assistant Professor, who shall not be a member of the Board of the College. Under this resolution no appointment has yet been made. Jasper T. Goodwin, Instructor in Mathematics, was promoted to the grade of Adjunct Professor, his appointment to take effect the 1st day of July, 1888.

Nicholas Murray Butler was promoted to the grade of Tutor in the department of Philosophy, Ethics, and Psychology, the appointment to take effect the 1st of July, 1887.

Leave of absence was granted to A. V. W. Jackson, Instructor in Anglo-Saxon and also in Zend, for the term of one year, to enable him to pursue studies in Avestan literature under Professor Geldner, of Halle, Germany.

*Attendance.*—The general attendance upon the entire university has been larger during the present year than ever before, but the increase in numbers has been greatly owing to the expansion of the Medical School in consequence of its improved accommodations.

*School of Arts.*—The number of students in attendance on the School of Arts during the year has been two hundred and thirty-three; of whom seventy-eight matriculated in the freshman class: sixty-three in the sophomore: forty-four in the junior; and forty-eight in the senior class. Three of these have received discharges during the year. If we deduct the forty-eight members of the senior class who will

complete their course at the close of this year, there will remain one hundred and eighty-two still connected with the college, against one hundred and eighty-nine at the close of the year previous. Of these, one hundred and eighty-nine who remained on the roll July, 1887, there failed to matriculate at the succeeding session the large number of thirty-four, of whom three were deceased during the vacation. The losses from year to year from this cause are very unequal. In 1884, twenty-two failed to return; in 1883, twenty-seven; 1882, thirty-five. These facts show an instability of purpose on the part of young men in college which is to be regretted.

*School of Mines.*—The number of students who have matriculated in the School of Mines during the year is two hundred and twenty-eight, of whom fifty-nine matriculated in the first year; seventy-three in the second year; fifty-four in the third year; and forty-two in the fourth year. Of this number thirteen have ceased to be connected with the school, leaving in actual present attendance, two hundred and fifteen. With the withdrawal of the graduating class at the close of the year there will remain one hundred and seventy-three, against one hundred and ninety-five in June, 1886.

*School of Political Science.*—In this school the total number of matriculates for the year has been sixty-two, of whom twenty-three have been nominally in the first year; twenty-six in the second class; and thirteen in the third class. The classification in this school is somewhat uncertain in consequence of the fact that a portion of the students attend in more than one class. Such students are not candidates for degrees.

*School of Law.*—The total attendance in the Law School for the year has amounted to four hundred and eighty-one; of whom two hundred and seventy-four were members of the junior class, and two hundred and seven of the senior class. Of this number two hundred and twenty-nine were graduates of fifty-six colleges and universities; of whom forty-four were graduates of Columbia College, thirty-two of Yale University, twenty of the College of New Jersey, seventeen of the College of the City of New York, and fifteen of Harvard University. The number of graduates in 1887 was one hundred and twenty-four, and the total number to date is three thousand two hundred and fifty-four.

*School of Medicine.*—The number of students in the School of Medicine is eight hundred and nine, without classification. This number was two hundred and three in excess of the matriculates of the preceding year.

*School of Library Economy.*—In this school, the number of admissions was thirty.

*Collegiate Course for Women.*—The total number of matriculates in this course was twenty-eight.

*Graduate Department.*—In this department there were thirty-six graduates in Arts and seven graduates of the School of Mines.

The grand total of attendance in all the departments amounted to nineteen hundred and fourteen. From this number, if we deduct fifty-one for repetitions, the remainder will be eighteen hundred and sixty-three, against sixteen hundred and two for the last preceding year; which is the largest total heretofore recorded.

## DEGREES CONFERRED IN 1886-87.

During the year ending in June, 1887, the following degrees were conferred :

## 1. IN THE SCHOOL OF ARTS.

Degree.	Number.
Bachelor of Arts . . . . .	44
Bachelor of Letters . . . . .	1
Master of Arts . . . . .	8
Doctor of Letters (honorary) . . . . .	23
Doctor of Laws (honorary) . . . . .	30
Doctor of Divinity (honorary) . . . . .	8
Master of Arts (honorary) . . . . .	1
Total . . . . .	115

## 2. IN THE SCHOOL OF MINES.

Engineer of Mines . . . . .	23
Civil Engineer . . . . .	14
Metallurgical Engineer . . . . .	2
Bachelor of Philosophy . . . . .	14
Doctor of Philosophy . . . . .	3
Total . . . . .	56

## 3. IN THE SCHOOL OF POLITICAL SCIENCE.

Bachelor of Arts . . . . .	8
Bachelor of Philosophy . . . . .	4
Master of Arts . . . . .	16
Total . . . . .	28

## 4. IN THE SCHOOL OF LAW.

Bachelor of Laws . . . . .	110
Total . . . . .	110

## 5. IN THE COLLEGIATE COURSE FOR WOMEN.

Bachelor of Letters . . . . .	1
Certificate of Proficiency . . . . .	4
Total . . . . .	5

## 6. IN THE SCHOOL OF MEDICINE.

Doctor of Medicine . . . . .	106
Grand total . . . . .	434

This unusually large number of degrees is owing to the occurrence of the Centennial celebration in April, 1887, at which time the honorary degrees were mainly conferred.

*Residences of Students.*—The localities from which the students of the various Schools are derived are shown in the tabular statement annexed. Of the students in Arts the attendance is principally from this city or the immediate vicinity. On this account students from New York City, Brooklyn, and Jersey City are separately entered, and are not included in the attendance from the States of New York and New Jersey. The totals for the States of New York and New Jersey therefore exclude the separate cities. In the professional schools the distribution is very general throughout the United States, and includes a limited number of foreign countries.

## RESIDENCES OF STUDENTS.

Residence.	School of Arts.	School of Mines.	School of Pol.Sci.	School of Law.	School of Medicine.	Graduate Department.	Course for Women.	School of Library Economy.	Total.
New York City . .	116	100	30	191	255	18	23	2	735
Brooklyn . . .	30	46	9	76	60	9			230
Jersey City . . .	4	4		4		2			14
New York State .	40	24	6	68	133	3	2	4	280
New Jersey . . .	27	22	9	41	102	2	2	2	207
Alabama . . . .		1		1	5	1			8
Arkansas . . . .					1				1
Bermuda . . . .					1				1
California . . . .				5	7				12
Canada . . . . .		1		1	5				7
Central America .		2			7				9
Colorado . . . .				2	2				4
Connecticut . . .	3	3		5	42		1	1	55
Cuba . . . . .		3			4				7
Dakota . . . . .					1				1
Dist. of Columbia				2	2	1			5
Florida . . . . .					2				2
Georgia . . . . .			1	2	5				8
Germany . . . . .					1			1	2
Illinois . . . . .	1	1	3	8	11			3	27
Indiana . . . . .					2			2	4
Iowa . . . . .		2		2	1				5
Japan . . . . .		1							1
Kansas . . . . .				3	2				5
Kentucky . . . .				1	3				4

Residence.	School of Arts.	School of Mines.	School of Pol. Sci.	School of Law.	School of Medicine.	Graduate Department.	Course for Women.	School of Library Economy.	Total.
Louisiana . . .		2		3	2				7
Maine . . . . .	1			1	10			2	14
Maryland . . .				3	1				4
Massachusetts .				3	22	1		11	37
Michigan . . .				2	4				6
Minnesota . . .				2	8				10
Missouri . . . .	2			2	5				9
Montana . . . .		1			2				3
New Brunswick .				1	1				2
New Hampshire .					6			1	7
North Carolina .					7				7
Nova Scotia . . .					3				3
Ohio . . . . .	1	5		6	10	1		1	24
Oregon . . . . .				2	6				8
Pennsylvania . .		1	1	6	13				21
Porto Rico . . .					1				1
Rhode Island . .		2		2	18			1	23
Scotland . . . .				2					2
South America . .					2	1			3
South Carolina .				1	2				3
Tennessee . . . .				1	3				4
Texas . . . . .				1	5				6
Turkey . . . . .					2				2
U. S. of Colombia					3				3
Utah . . . . .	2								2
Vermont . . . . .	1		1	2	7				11
Virginia . . . . .		2			7				9
West Virginia . .		1	1	1	1				4
Wisconsin . . . .				8	4			2	14
Totals . . . . .	228	224	61	461	809	39	28	33	1863

*Ages of Undergraduates in the School of Arts.—*

The following statement exhibits the average ages of the students matriculating in the School of Arts at the last birthday preceding their matriculation, together with the extreme ages in each class :

Class.	No. in Class.	Average age.	Oldest.	Youngest.
Seniors,	48	20 $\frac{7}{8}$	24	18
Juniors,	44	19 $\frac{1}{4}$	25	17
Sophomores,	65	18 $\frac{1}{2}$	20	16
Freshmen,	78	17 $\frac{5}{8}$	21	14

As these numbers were given for the beginning



of the year, the average age of the senior class at graduation will be a little over twenty-one years.

*Scholarship.*—In past years it has been customary to present a statement of the relative scholarship of the students in the School of Arts at the close of each year. This has been founded on the results of a system of marking for the values of scholastic performances of the students in the several departments. As much dissatisfaction has been expressed by both students and Faculty with this artificial method of estimating merit, it has been resolved to try the experiment of discontinuing the numerical marking system, and in place of it require semi-annual reports from each instructor, of the names only of those who are proficient in each study, and of those who are deficient; and in order to provide honorable distinction to the most meritorious, each head of department is required to report at the close of the final examination in each year, the names of those students, not exceeding three in number, who, in each class have displayed the greatest excellence in the studies of his department; and any student who is so reported as proficient in all departments, is to be reported as an honor man. The names of the honor men are to be recorded in the register of the ensuing year. This plan having been introduced in the course of the current year, the results will not be reported until the close of the final examination, and will be given in succeeding reports hereafter. Thus far the plan seems to be regarded as likely to prove successful.

*Discipline.*—For many successive years it has been customary to notice in these reports the degree to

which good order has prevailed in the institution. It is an unfortunate fact that young men cannot be collected together in great numbers in institutions of learning without being subject from time to time to excitements which seriously interfere with the purposes for which they are nominally assembled. All colleges are liable to disturbances of this character; but it is gratifying to be able to state that Columbia College has for many years been free from any serious evil of this nature. An important cause of this exemption is undoubtedly to be found in the fact that the undergraduate students of this college reside chiefly at home, and are not subject to the demoralizing influences which often prevail when immature youth are aggregated in large bodies in buildings where they are left for a great part of the time without supervision, either domestic or municipal. The system so generally prevalent, according to which inexperienced men are abandoned in the morning of life entirely to their own control, though it seems to be generally accepted as necessary, is attended with very serious evils. It is a system very different in its original intent from what it has grown to be. In the collegiate systems of the earlier centuries it was designed that the student should be subject to the constant supervision of the governing body, and students and teachers were required to reside under the same roof. The abandonment of the principle of surveillance so long maintained has been unaccompanied by any adequate safeguard, and the consequence is that the young men of our collegiate institutions are left practically free from any restraint upon their freedom of action. It is only surprising

that with such large opportunities for unrestrained irregularities of conduct, American youth are, on the whole, so free from gross improprieties of deportment. We have reason to be greatly gratified, to whatever cause it may be owing, that our own college throughout its history has so rarely been subject to troubles from this cause.

*Athletic Games.*—In recent years increasing attention has been continually directed to the importance of physical culture among young men in colleges. There is reason to believe that if the importance of this subject has not been exaggerated, at least the methods employed for encouraging it have been more or less mistaken. If vigorous exercise should be practised by a portion of the young men under instruction in college, the same ought to be the case with all ; yet it is doubtful whether the great proportion of the students in any of our colleges participate in the exercises which are esteemed so important. They certainly do not do so in institutions which are unprovided with regularly equipped gymnasia ; and even where such advantages are possessed, there is rarely any constant and persevering practice. It is too often the case that at the beginning of a session young men are animated for a week or two by a very lively zeal to participate in athletic sports, which in a brief period wears itself out ; after which the gymnasium is for the most part deserted. What is more likely to happen is the selection of a limited number of athletes who are supposed to possess more than usual skill and who are charged with representing the college in their match games with other institutions. They will thus designate, for example, the base-ball

team, or foot-ball team, or the boat crew, to whom will be committed exclusively the maintenance of the honor of the college in this particular field. Those not thus selected will relapse into the sluggishness of previous years, and thus the mass of the students will derive very little benefit from the efforts thus made for their physical improvement. This is undoubtedly very seriously to be regretted. It is to be regretted mainly because it is a disappointment of a very worthy and desirable object; but it is to be regretted also because it entails upon the students a serious burden of expense—an expense which, under college usages, can hardly be avoided. Though a very limited number of young men actually participate in these sports, the burden falls more or less on all alike. The expeditions got up to visit sister colleges in these trials of agility or skill involve serious expenditures, and as the representatives of the college are charged with the responsibility of maintaining the reputation of the entire body, they can hardly be expected to do so at their own charge. Another evil attends the practice now become so common of inter-collegiate matches. Though but a limited number engage personally in these games, yet the interest taken in them by the mass of the students is general and absorbing. As these contests approach, there is more or less distraction of the minds of the students from their proper pursuits, and for the time being a more or less serious neglect of study. This is an evil inevitable while the present system is maintained, and is of sufficient magnitude to justify, in the opinion of the undersigned, an absolute prohibition of inter-collegiate games altogether.

The evil was not one originally anticipated. In the encouragement given to athletic sports it was hoped that the physical vigor of the students generally might be promoted, and so that the great desideratum of "a sound mind in a sound body" might be secured to all. The perversion of the system by which whatever benefit may be enjoyed accrues only to a small number, while the burden of expense comes equally on all, has practically destroyed the usefulness of the system, and given it another character, more an injury to the cause of education than a benefit. It is well worth consideration whether boating clubs or match games of any sort beyond the limits of the university itself ought not to be totally prohibited. Columbia College may be entitled to speak on this subject with some degree of authority, as she was one of the first of the colleges to offer encouragements to athletic sports by directly subsidizing them; but in doing this the Trustees had no other object but to promote physical exercise among the students within the institution itself. More than twenty years ago there began to be made annually a considerable appropriation under the title "gymnastic exercises." The intention of this was principally to defray the cost of implements, and the occasional rent of grounds. The spirit of emulation, however, soon led the young men to a practice which, at the time, amounted to an abuse. The appropriation granted by the Trustees began to be applied to the purchase of prizes to be awarded to the most successful competitors. This was at first objected to, but in the end it was granted, and the practice may have had the effect to make participation in these

sports more general. It continued in effect for a number of years, but in the springing up of inter-collegiate matches the general practice of athletics sooner or later disappeared.

The absence of a regular gymnasium has, however, been a great discouragement to the general practice of athletic sports in this institution. Two years ago there was an effort made on the part of alumni of the college to secure a fund for the erection of a well-appointed gymnasium in the vicinity of the college grounds. Plans and estimates were made for the necessary building and ground, and the probability seemed then that the object would soon be realized ; but the scheme seems to have fallen through, or only seems likely to be accomplished when the Trustees shall be able, if that shall ever happen, to carry out the design at their own expense.

In the much discussion which has taken place on this subject in the public press during the past year, it has been imputed as an evil attendant upon inter-collegiate matches that they have a tendency to give an advantage in regard to numerical attendance to those institutions which are most successful in these competitions. Opinions were sought by a leading journalist in Boston from the heads of a large number of colleges, as to the presumed effect of athletic successes in increasing the attendance upon institutions which had won honors with more than usual frequency in games of skill. No doubt there has been prevalent an opinion to this effect extensively in the community. The heads of colleges generally, however, concurred in the belief that this effect had been materially imperceptible. The opinion was ex-

pressed that in a matter of so grave importance as a choice of a college, a consideration so insignificant as a loss of a boat race or ball match would have no material weight with a young man desirous to secure a good education, and still less with his father. It is still, however, undoubtedly true that a young man will reflect with pride on the fact that the college to which he belongs can boast an honorable athletic record, and though this consideration may not have often a prevailing influence, it is hardly to be doubted that it counts for something.

*Elective Studies.*—For more than twenty years Columbia College, during a portion of the course, has maintained a system of study partially free. During the senior year at present the studies are altogether elective. The junior class are confined during two-thirds of the time to a course of study specifically prescribed. It follows that certain studies will be elective by both seniors and juniors, and others elective by seniors only. In the following tables the distribution is given in each of the subjects belonging to these two categories :

## STUDIES ELECTIVE BY SENIORS ONLY.

	Number in class	Number electing.
English	48	15
Astronomy	26	17
Philosophy	17	11
Ethics	11	15
Chemistry	15	17
Political Economy	17	22
Constitutional History of Europe	22	8
Constitutional History of England	8	4
Geology	4	4
Anglo-Saxon	4	1
Navigation	1	2
Practical Astronomy	2	

## STUDIES ELECTIVE BY BOTH JUNIORS AND SENIORS.

	Seniors.	Juniors.	Total.
Number in class . . . . .	48	44	92
Greek . . . . .	12	4*	16
Latin . . . . .	28	20*	48
Mathematics . . . . .	5	11	16
Physics . . . . .	24	29	53
Botany . . . . .	13	16	39
French . . . . .	23	11	34
German . . . . .	15	17	32
Spanish . . . . .	3	2	5
Italian . . . . .	4	3	7

\* In addition to this elective Latin and Greek, the same languages are compulsory upon the junior class for two hours weekly each throughout the year.

The modern languages, French, German, Italian, and Spanish, are elective in the freshman and sophomore classes as well as also in the classes above. The following statement shows the relative distribution of these languages in the two lower classes.

## MODERN LANGUAGES ELECTIVE BY SOPHOMORES AND FRESHMEN.

	Sophomores.	Freshmen.	Total.
Number in class . . . . .	65	78	143
French . . . . .	33	43	76
German . . . . .	28	31	59
Italian . . . . .	0	0	0
Spanish . . . . .	2	2	4
Specials, electing none . . . . .	2	2	4

## TOTAL NUMBER ELECTING MODERN LANGUAGES.

Total number of students . . . . .	235
Number electing French . . . . .	110
"    "    German . . . . .	91
"    "    Spanish . . . . .	9
"    "    Italian . . . . .	7

The final statement here given, which shows the total number of students pursuing the several modern languages respectively without regard to classification, makes it appear that the Spanish and Italian



languages are sought by comparative few. This is owing to the fact that the other two, French and German, or one of them, has heretofore been compulsory to the exclusion of any other. The Italian or Spanish or Scandinavian were permitted only to such students as were already proficient in French or German. This regulation has been since discarded and this disadvantage has been removed. The effect will be perceived later.

*Lenten Lectures.*—In the last annual report of the undersigned it was stated that, by a spontaneous movement among the students, a request had been prepared with the signatures of a large number of students, asking that certain eminent clergymen of this city and Brooklyn might be invited to address to the students from time to time during Lent, a series of brief religious discourses in connection with the regular morning Chapel services. This request was endorsed by several members of the Faculty, and also by several Trustees, and was very willingly complied with. The effect was so beneficial that the undersigned contemplated an extension of the system for a larger portion of the year, and he had begun to make arrangements to that effect about mid-winter, when his plans were interrupted by the failure of his health. As Lent approached, however, the students renewed their request of the previous year, and they were encouraged to issue invitations as before. In the previous year the invitations were confined entirely to clergymen of the Episcopal Church. This year a desire was expressed to include a number from other denominations, to which request permission was very freely granted. The gentlemen who have had the

kindness to contribute these very instructive addresses have been : Rev. Richard D. Harlan, Rev. S. De Lancey Townsend, Rev. Wm. S. Rainsford, D.D., Rev. H. T. McEwen, Rev. Henry A. Adams, and Rev. Henry van Dyke, D.D.

*Free Public Lectures.*—During the last two years there has been maintained a series of public lectures open freely to citizens as well as students. These have been given on the successive Saturday mornings. They have been given principally by officers of the college, but also in some instances by well-known literary men. They have been attended by a considerable concourse of citizens, and there has been manifested a remarkable interest to secure admission. Though many tickets have been issued in excess of the capacity of the hall, we had constant applications for tickets which we were not able to supply, and were compelled, to our great mortification, to refuse. Every day we feel more and more the disadvantage of having no accommodations adequate to an exigency of this kind. In the scheme proposed as above stated for the erection of a gymnasium, provision had been contemplated at the same time for a large assembly hall to meet not only large lecture audiences but also public meetings of students, commencement exercises, and similar occasions. When the plan for erecting a Law School and Library was in contemplation, a large assembly hall was a principal feature of it, but that plan was ultimately abandoned under what was thought to be the pressure of necessity. How the difficulty is to be overcome without a total abandonment of the present site of the college, and seeking another locality, will not be

a problem easy of solution. There has not been a step of progress taken, attended by more satisfactory results than this system of free public lectures, and nothing is more desirable than that the system should receive a large expansion and development.

*The Graduate Department.*—The growth of the desire for attainments superior to the grade of undergraduate study in this country has in recent years become very marked. A number of our higher institutions of learning have made specific provision for this class of students. If the disposition of our young graduates to resort to foreign universities for superior education has not ceased, it has to a great extent given place to a gradually growing preference for the opportunities offered by our own higher institutions for instruction of the same character. Johns Hopkins University has from the beginning devoted itself chiefly to this description of higher education. Harvard, Yale College, and also Princeton have been successful in attracting a large number of such graduate students, which for many years has been steadily increasing. Columbia College has more recently engaged in work of the same description and our experience here has corresponded with that of our sister institutions in a steady but slowly increasing attendance. The origin of this movement may be traced to the institution, nearly twenty years ago, of the system of Prize Fellowships, by which the desire was stimulated for advanced attainments in letters and science. Originally it was not contemplated that our Prize Fellows should receive instruction in the college itself. They were, on the other hand, encouraged to resort to foreign universities,

and subject to no constraint as to the manner of prosecuting their studies, but the obligation to report the character of their work periodically to the president. As a rule, the Fellows elected under this system became honorably proficient, and on their return from abroad obtained preferment to subordinate positions in instruction in our own college and elsewhere. After a time it became obvious that it might be advantageous to make attendance at our college compulsory, while by this means we could secure the advantage of making of our Fellows contributors to the service of the institution, by annexing them as assistants in the different departments. The Graduate Department was accordingly constituted in 1880, since which time it has received about twenty additions by appointment of Fellows, which number has been considerably increased by voluntary accessions.

Simultaneously with the creation of the Graduate Department there was established the School of Political Science which is practically a school of graduate study, and of which the subjects are included in foreign universities under what is called the "Philosophical Faculty." The German universities are in fact practically schools of professional study. All our associated schools fall properly in the province of university instruction and there is therefore, in the inevitable drift of things, a tendency to concentrate our energies upon the Graduate Department. This has been so distinctly perceived by the Trustees that there has been a distinct effort made from time to time to convert Columbia College altogether into a school of post-graduate instruction. About thirty

years ago this effort assumed the form of a publicly declared purpose, and after a very elaborate investigation resulted in the constitution of a definite university organization. The time was not ripe, however, for so large a step of progress, and the effort failed to prove a success. Out of it, however, grew the Law School, which meeting a well-ascertained public want, proved immediately successful and has been permanently maintained. Some years later the School of Mines appealed to a public want similarly ascertained, and was accordingly in like manner successful. The operations of the institution have in recent years extended over so wide a field that the original college has been entirely overshadowed, and a doubt has been raised whether its usefulness has not ceased. A resolution is now pending before the Board, inquiring whether it is not advisable that the whole scheme of education in Columbia College should be raised to a higher plane, and which involves the further question whether it is not advisable to discontinue the department of Arts. So long as this question remains under discussion before the governing board, it would not be becoming in the undersigned to pronounce an opinion upon it here. It may be permitted, however, to say in this place, that if the question were merely as to the sufficiency and importance of the work proposed, there could be no doubt that our Faculties could find ample and adequate occupation if they were confined to giving instruction exclusively to graduate students. On the other hand, such has been the excessive multiplication of undergraduate colleges in our country in recent years, that the business of those colleges is greatly

overdone, and it would certainly be a material benefit to the educational interests of our country, if a large proportion of the existing colleges could be suppressed. From statistics gathered by the undersigned in former years with great labor, it was made manifest that while in the last half century the proportion of students in Arts in American colleges has been gradually but steadily diminishing, the number of colleges has on the other hand more than correspondingly increased. Since about 1837 the population of the country has increased fourfold, and the number of colleges threefold, while the number of students in Arts has in the meantime only doubled. In the country generally the number of students under instruction at any given time is in a proportion of about 1 to 2,000 or 2,500. In 1830 the average attendance on the existing colleges was sixty-seven each, and in 1880 about forty each. There is not a State in the Union in which the number of colleges is not greatly in excess of the educational needs of the population. This city itself may be taken as an illustration. New York has about a million and a half of inhabitants. It should be capable of furnishing, therefore, at the ratio of 1 to 2,500, six hundred undergraduate students in Arts. This is not a number greater than could be comfortably provided for in a single college. Nevertheless we have three, not counting the minor colleges under the care of the fathers of the Roman Catholic Church. It would not be therefore educationally a misfortune if Columbia College should cease to exist as a school for undergraduate students. The city would still be fully supplied with educational advantages, while there could be no doubt

that this institution could be more profitably employed by confining itself to the field of superior education. Whatever be the policy pursued in this matter, nevertheless it is the unavoidable tendency of things to press upon Columbia College more and more constantly from year to year the duty of providing for the wants of the superior class of students, that is to say, the business of proper university instruction. The location of the institution in the greatest city of the continent is peculiarly favorable to such an undertaking, and though the college is not possessed of funds sufficient to enable it to carry out this complete design, it is hardly to be doubted that provision may sooner or later become sufficient to accomplish this object. One advantage which we already possess toward it consists in the Library, which, although incomplete in some details, goes far toward supplying the needs of students engaged in literary or scientific research, and this is a possession which in the nature of things must constantly improve in value.

*The Library.*—As the importance of our library for purposes of superior instruction is becoming every year more and more felt, the necessity for an extension of its accommodations must necessarily early occupy attention. The use of the library is continually increasing, so that it is not an infrequent occurrence to find it impossible to obtain even a seat. The committee on buildings and grounds has recommended the introduction into the library of elevated reading-rooms, which will, to a certain extent, double the accommodations, and for a certain length of time relieve the pressure. It will not provide, however, the additional shelf room which will be soon needed

in consequence of the natural and unavoidable enlargement of the collection. There seems to be considerable difference of opinion as to the kind of enlargement to be adopted. To extend the present library building directly north to Fiftieth street has seemed to the undersigned to be the most judicious improvement which we could adopt ; especially as that would be attended with the advantage of at the same time securing a very desirable enlargement of the accommodations for the observatory. But it is greatly to be feared that no plan can be proposed which can provide adequately on the present site for all the various and increasing operations of the institution. It would seem as if, before incurring greatly increased expenditure on this ground, every endeavor ought to be exhausted to ascertain the possibility of obtaining an enlargement of our present site or to effect the removal of the entire institution to quarters of more adequate dimensions. In the nature of things these questions cannot be indefinitely postponed. By the end of this century, unless relief can be in some manner obtained, the situation will become intolerable, and considering the deliberation with which great bodies usually move, the solution of the problem is not likely to be found in less than another decade, even if attention is given to it immediately and continuously.

When, sixteen years ago, the Wheelock property was acquired, this troublesome matter was believed to have been finally disposed of, and possibly had the institution been at that time removed to the newly acquired site, the matter might have by this time settled down into a position more or less satisfactory.



But the present difficulties in the way of transferring the college to a site so distant would be so great as to render the measure impracticable. The occupation for building purposes of most of the land adjacent to the present college site, renders the acquisition or annexation of any neighboring lots objectionable except at an expense which would be practically prohibitory. The difficulties surrounding the situation suggest nevertheless the importance of losing no further time in endeavoring to dispose of them, since they cannot fail to increase steadily with the lapse of time.

#### THE ASSOCIATED SCHOOLS.

*The School of Law.*—The School of Law has been marked during the past year by an apparent recovery from the temporary depression which had followed the adoption of the rigorous rules in regard to admission to the bar imposed by the Judges of the Court of Appeals, and the attendance has once more nearly reached the extraordinary totals of the years 1875 and 1876, This is very satisfactory as an evidence of the high appreciation in which our school continues to be held, though it is not obvious that excessive numbers are advantageous to the students themselves.

The scheme of extending the course of instruction to a longer period, which has been so long under consideration, although not yet definitely decided on, has been subject of careful consideration by a select committee and will probably be effected and carried into operation during the ensuing session.

*The School of Political Science.*—There is not much

to be added to what has been said in regard to this school in former years, only that it may be said to be steadily growing in favor and usefulness. The actual attendance on the school is considerably greater than appears in the register, in consequence of the provision which permits students of the Law School to attend also the School of Political Science without additional fee. These, after matriculating in the School of Law, avail themselves of the privilege of attending in this school also without originally matriculating in it. This privilege is attended with material advantage to the law students, and contributes to make them, in a scientific point of view, a superior class of lawyers.

The Academy of Political Science continues to be actively maintained and contributes materially to the usefulness of the school. *The Political Science Quarterly* continues to maintain its established reputation, and has aided materially to make the school and its methods known to educationists at home and abroad.

During the past year the school has been strengthened by the appointment of an additional professor of political economy. Dr. E. R. A. Seligman, who has been promoted to the post from the position of lecturer, is a graduate of the school who had been appointed a prize lecturer and had served in that capacity with acceptance for two years. He has devoted his attention principally to the history of the subject and is regarded as a valuable acquisition.

*The School of Mines*—so continuing to be called notwithstanding that the title has long ceased to be descriptive—has completed another year of its useful work. It is in the summer classes, maintained in

this school during the vacation, that we find the most interesting part of the year's history. There are now five independent summer classes connected with the school, of which the earliest established has been ten years in operation ; this is the class of practical mining, which was first instituted in the summer of 1877, under the charge of Prof. H. S. Munroe. The object of this class is to introduce students in mining engineering to familiarity with mining operations in the field, and so accustom them with the real work of mining and mining constructions as to enable them to deal intelligently with the actual work in which they will have to be engaged in professional life. Though the students are not required to make use of tools themselves (although on some occasions they have done this), they are required to obtain a thorough understanding of the manner in which tools should be used, and with the amount of work which should be reasonably expected from the operatives by whom the work is actually executed. They are required also to study the constructions necessary in excavating minerals from their beds, raising them to the surface of the earth, and subjecting them to the mechanical processes by which they are to be prepared for reduction. They secure a practical acquaintance also with the different forms of machinery used in mining and ventilation and transportation. All these subjects they study theoretically during term time in the school, but they can only acquire adequate acquaintance with them by being brought into contact with the actual operations of real work in the mines themselves, and by contact with the men engaged in mining as a regular business.

Inasmuch as the work of mining is largely various, it is impossible in a single season to study it in all its varieties. From year to year, therefore, the localities visited are changed in order to give the young men as large a variety of experience as practicable. Accordingly, in past years, mines of iron, copper, zinc, and coal, have been made subject of study; the precious metals not having as yet been made a subject of special attention, partly because the localities are generally so distant, but more especially because the so-called useful metals are of so very superior practical importance. The field of operations visited during 1887 was, in the early part of the session, in Morris Co., N. J., at the Thomas Iron Co., near Port Oram. This locality was found so interesting and instructive that it occupied the greater part of the attention of the class; but later, a briefer time was spent in the anthracite coal regions of Pennsylvania. The report upon this work by the directing professor, which will be found in the appendix, contains a statement of the work accomplished in both localities. The professor acknowledges with gratification the kindness and courtesy with which the class has been received by the proprietors of the works visited, and by the officers and operatives in charge of them.

*Summer Class in Surveying.*—The class in surveying, for the season of 1887, was held in the same locality which was occupied for two or three successive years before, and which has been found on all accounts the best adapted to the purpose of any as yet visited. It is situated at a distance of a few miles from the pleasant borough of Litchfield, Conn., and embraces a widely diversified surface, admirably

adapted to the purposes of the class. Here has been in fact established a camp designed to be occupied for successive years indefinitely. It has the advantage of being in the immediate vicinity of a spacious hotel or boarding house, occupied occasionally as a summer resort by the people of the neighboring towns. The students are enabled, therefore, to obtain board of excellent quality, and at reasonable prices, while they occupy at night their own quarters. The undulating surface of the ground affords abundant opportunity for practice in all descriptions of surveying operations, including levelling and plane table topography, while the large supply of instruments enables every individual to become familiar with practical methods in all their variety. A lake of several square miles in dimensions furnishes opportunity also for practice in hydrographic surveying, which adds materially to the advantages of this situation. The class of 1887 was uncommonly large, embracing fifty individuals, and would have been embarrassing but for the assistance of two voluntary aids, who contributed materially to relieve the assistants whose appointments were authorized by resolution of the Board of Trustees. These assistants, Mr. Karl E. Eilers and Mr. Edward F. Weekes, rendered also a service of especial value by making a detailed reconnaissance of the country about the lake, and between the lake and the village of Litchfield, establishing a base line, and constructing a regular triangulation, constituting, in fact, a regular geodetic survey of some miles in extent, determining trigonometrically the exact positions of a large number of conspicuous objects. If it should be found practicable

hereafter to prosecute the work thus begun by Messrs. Eilers and Weekes, there may result an unanticipated advantage in bringing into co-operation the annual class in surveying and the class in geodesy, conducted under the direction of Professor Rees.

*Summer Class in Mechanical Engineering.*—The summer class in mechanical engineering differs in one respect from the other summer classes in that it is not a compulsory organization, but was originated and has been maintained for the last ten years by the voluntary action of the students themselves. This action was prompted by a desire on the part of students to familiarize themselves with the operations of machinery employed in actual work. From the necessity of the case the field of observation is limited to the few large foundries or machine shops which can only be found in our great cities; and, considering the extent to which the large class of curious young men are liable to interfere with the convenience of operatives in a great shop, it is a little remarkable that we have found so little difficulty in securing for our students the opportunities for observation which they desire, and which are so useful to them. We have found, however, for several successive years, a courteous and cordial reception at the great Delamater Iron Works, of West Thirteenth Street and North River, and every opportunity has been granted which is desired to study and take drawings of the machines and tools in use in this large establishment. The summer class in mechanical engineering is composed largely of the same individuals who are required later in the vacation to attend the summer class in surveying; and, after the institution of this class, there

was some reason to apprehend that the class in mechanical engineering would have to be abandoned for want of time. Happily this apprehension was not realized, but the class was not attended so numerously as the class in surveying. This was not owing, however, to any falling off in interest, the fact being that there is rather a more general desire to become attached to that class than is altogether convenient; the professor having found it necessary to exclude from the class all students who are not satisfactorily proficient. For further details in regard to this class reference is made to the report of Prof. Hutton in the appendix.

*Summer Class in Practical Geodesy.*—The summer class in practical geodesy was conducted during the summer of 1887 by Professor Rees, assisted by E. L. Stabler, Esq., and L. M. Luquer, Esq., Fellows in Science. The time of the class was occupied immediately after commencement, for about three weeks, with astronomical work in the Observatory. On the first of July the class assembled at Cooperstown, N. Y., for the continuation and completion of the geodetic survey of Otsego Lake. The courtesies extended to the class in former years by the Director of the State Survey, J. T. Gardner, Esq., were continued by the present Director, Elnathan Sweet, Esq., State Engineer, who kindly loaned the class the fine theodolite belonging to the survey, which was an important assistant in determining directions. In addition to the work in the Observatory and the field, the students were required to prepare memoirs on some subject prescribed to them, and the professor reports that these memoirs show remarkable care in prepara-

tion, and a desire to secure original information. The titles of these memoirs are given in the report of the professor, contained in the appendix.

*Summer Class in Chemistry.*—The summer class in chemistry was held for the first time in the season of 1887. It was authorized at so late a period in the year as to make it impossible to have notice generally given of its institution, so that one of the objects which had been hoped to be accomplished by it was not, for this year at least, secured. This object was to afford young men an opportunity to acquaint themselves with the principles of chemical analysis during a season when they are usually more at leisure to profit by it than during the colder season. The attendance of students already in the School of Mines was nevertheless considerable, amounting to forty-eight in all, besides which there were nine special students not previously connected with the school. The appropriation for the maintenance of the class amounted to one thousand dollars (\$1000), of which the entire amount was expended except sixty cents. The receipts were seven hundred and thirty dollars (\$730), showing an actual deficit of two hundred and sixty-nine dollars and forty cents (\$269.40). The probability is that in the future the receipts will more than cover the expense. It appears to the undersigned that the result of the experiment has amply justified the undertaking, and that this class is likely to be hereafter an important addition to our educational instrumentalities.

*The School of Library Economy.*—For the first time in January, 1887, there was opened a school in Columbia College for the training of librarians. The



profession of a librarian has become in recent times a vocation of so great importance to the public as to render it very important that some means should be found to properly prepare persons for positions of such responsibility. Such opportunities have not been heretofore provided, and there has been apparently open to us a means of performing a public service of great value by making our library an instrumentality for forming other librarians. The project was regarded as an experiment of uncertain issue, and in the beginning we did not reduce the plan to an entire system. Our aim was in the beginning rather to feel our way than to define explicitly a matured project. We proposed, therefore, to make the opening session a brief one of three months only. We had no expectation of instructing a large number of students. Our first surprise came when, two or three months in advance of the opening, we began to receive applications for admission in such numbers as to threaten to exceed our accommodations, so that we were obliged to exercise considerable severity of selection. We ultimately limited the number received to twenty, and we found that this moderate number was sufficient to keep our library officers exceedingly busy. It was a source of great gratification to us, however, to discover among our students a remarkable degree of assiduity of application and zeal in the pursuit of knowledge, which amply compensated for the heavy burden thrown upon the teachers. Though the students had been promised only three months' tuition, they presently united in an unanimous petition to have the time extended for an additional month, a petition which we had not the heart to

refuse. We were greatly assisted and encouraged in our labor by the voluntary aid rendered us by many able and interesting lecturers from a distance, some of whom contributed series of connected lectures, while a larger number lectured once or twice.

During the present session we have received similar valuable aid. Nearly thirty persons connected with libraries, college faculties, and publishing houses, and other persons conversant with books, have addressed our students on one or more occasions during this session, and have conveyed to them an amount of valuable instruction which they could not otherwise have received. Among these have been : Prof. R. C. Davis, Librarian of the University of Michigan ; W. E. Foster, Esq., Librarian of the Providence Public Library ; Prof. Joseph H. Gilmore, Professor of English Literature in the University of Rochester ; Samuel Swett Greene, Librarian Worcester Free Public Library ; Ainsworth P. Spofford, Esq., Librarian of Congress ; Dr. John S. Billings, Librarian National Medical Library ; C. A. Cutter, Esq., Librarian Boston Athenæum ; Reuben A. Guild, Esq., Librarian Brown University ; Appleton Morgan, Esq., President N. Y. Shakespeare Society ; W. T. Peoples, Esq., Librarian N. Y. Mercantile Library ; Gustav E. Stechert, Esq., foreign bookseller, N. Y. ; and Justin Winsor, Esq., Librarian, Harvard University. Many of these lectures have been heard by other students and officers of the college besides the members of the School of Library Economy, and have constituted a series of very attractive entertainments.

The regular course in the school, for which certifi-

cates will be granted to proficient, will be definitely fixed at not less than two years. The value of the instruction to the students may be judged by the fact that before the close of the brief session of the school last year, every student attending was already under solicitation for appointment to some place worth accepting, as a librarian or assistant librarian in some desirable locality in the country.

Under the conditions according to which the school was constituted by the Trustees, the burden of instruction falls entirely upon the persons employed in the library. It was not at the beginning anticipated that this burden would draw so heavily on their time or would interfere so largely with the ordinary duties of their positions. As the school has proved so large a success and vindicated its title to be permanently maintained, it will have to be considered sooner or later by what means these conflicting duties can be provided for without disparagement to the school on the one hand and the library service on the other.

*School of Medicine.*—Nothing in American educational history is more remarkable than the evidences of public favor with which the recent improvements in the School of Medicine have been received. The necessity of a change of location has for many years been obvious, in consequence of the continually increasing numbers annually thronging the halls of the school; but it would appear as if the difficulty had hardly been obviated by the immense enlargement of the accommodations for lecture halls and collections furnished by the new buildings. The growth in numbers has corresponded very nearly with the enlarge-

ment of space, and it seems probable that it will become necessary to impose a limit to the number of matriculates admitted.

The fact that this increased attendance has occurred in spite of a simultaneous increase in the rigor of the conditions imposed on candidates for admission and graduation, is a circumstance equally gratifying. It has been a reproach to the medical schools of the country that they are injudiciously lax in their requisitions in regard to proficiency; and that in many graduates are found who are incapable of understanding their own prescriptions, and even, in some instances, of correctly writing the English language. This reproach will not hold good hereafter of our medical school. The final examinations of this year have been very thoroughly searching, and arrangements have been made for enforcing entrance examinations equally rigorous hereafter. If these measures shall have the effect to repress the great affluence of numbers which have been received during the past year, the fact will be no cause of regret, since what in this way may be lost, will greatly more than be compensated in the character and respectability of the profession. The undersigned feels that he can safely reaffirm the conviction that the Medical Department of Columbia College is destined to become in the future the leading medical school in the United States.

*Apologetic.*—The conditions under which the present report has been prepared have been such as to make it impossible to bestow upon it the usual amount of labor and time. The health of the undersigned has for two or three months been so fluctu-

ating that he is conscious of having been able to give but a superficial survey of the work of the past year. The matters of most essential importance, however, have been brought to the attention of the Board ; and if there has been any important omission, he will be happy to furnish any supplementary information which may be called for.

The undersigned has held his office nearly a quarter of a century and has served a term exceeding in length that of any of his predecessors. The period has been one marked by a great development in the work of the institution, and a point has now been reached which seems very critical in the history of the college. The undersigned had hoped that it might be permitted to him to be able to participate in the measures which must be taken during the next few years to extricate the institution from its present embarrassments ; but that is hardly to be hoped. It is satisfactory nevertheless to believe, that the interests of the college are in judicious hands, and that though the solution of the problem is not at present obvious, it will work itself out ultimately in a satisfactory manner. Whatever his relations to the college may continue to be, the undersigned will never cease to cherish a deep interest in all that relates to it, nor to bestow his best efforts for the increase of its prosperity and usefulness.

All which is respectfully submitted,

F. A. P. BARNARD,

President.

Columbia College, May 7, 1888.



## APPENDICES.





## APPENDIX A.

### REPORTS ON THE COURSE OF INSTRUCTION IN THE SCHOOL OF ARTS.

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#### DEPARTMENT OF GREEK.

##### *To the President of Columbia College :*

The subjects of study, with the hours of attendance of the several classes in the department of Greek, for the past academic year have been as set forth in the following report :

*The Senior Class*—Greek Section—has attended the Jay-Professor of Greek two hours per week throughout the year, and has read the Olympic and part of the Pythian Odes of Pindar, with commentary from the professor on the subject-matter, dialectic forms, and the character and style of the author. In addition the class has read the Oration of Demosthenes on the Crown, with constant reference to contemporary history, and explanations of legal and political matters.

A section of the same class has attended two additional hours per week throughout the year, and has read the Idyls of Theocritus and the four books of Xenophon's *Memorabilia*.

*The Junior Class*, divided into two sections, has attended the Jay-professor of Greek two hours per week throughout the year, and has read the *Electra* of Sophocles, with full explanations of the grammatical, metrical, and archæological matters of interest calling for special remark, of the choral scanning, and of scenic representations.

In addition the class has read in prose the *Protagoras* of Plato, with analysis of the dialogue and discussions on the methods and teachings of Sophocles.

A small section of this class elected Greek for one hour per week in addition, and has read the *Clouds* of Aristophanes, and for sight reading the *Enchiridion* of Epictetus.

*The Sophomore Class*, divided into three sections, has attended Dr. Perry (in the absence of Dr. Merriam, Adjunct Professor of Greek) three hours a week throughout the year, and read the *Hippolytus* of Euripides, with exercises in the scansion of Anapæstic and Iambic measures, and in some of the simple choral measures. Besides the regular daily review the class voluntarily on two successive afternoons read the whole play, completing it in somewhat less than four hours.

In the second term, the same class read selected portions of the sixth and seventh books of Thucydides, so arranged as to form a continuous narrative of the Sicilian expedition.

*The Freshman Class*, divided into four sections, has attended Dr. J. C. Egbert, Jr., Tutorial Fellow, and Mr. Nicholas E. Crosby, Honorary Fellow (each having charge of two sections), three hours a week through the year, and read in the first term the sixth and seventh books, and the greater part of the eighth book of the *Odyssey* of Homer. Particular attention was given to the grammatical forms and the dialect variations, to the Homeric syntax, in comparison with Attic, and to Homeric versification. The class read, in the second term, the greater part of the seventh book of Herodotus, attention being paid to the style and dialect of Herodotus, and to contemporaneous history. The class had practice also in reading at sight from selected passages of Herodotus.

This class attended Dr. Perry, Tutor in Greek, once a week throughout the year for Greek syntax and exercises in Greek prose composition.

A class of volunteers was formed for additional Greek reading, under the charge of Mr. Crosby, which met their instructor twice a week and read with him the second book of *Pausanias*, and the description of the Athenian Acropolis from the first book. Mr. Crosby was able to explain

the antiquarian notices of Pausanias from his residence in Athens and his connection with the School of Classical Studies there during the preceding year.

*The Graduate Class* has attended the Jay-Professor twice a week, and has read carefully the first books of Thucydides, with analysis of the books as completed, and written translations of the more difficult speeches. Attention has been given to the style and syntax of Thucydides. Grote's History of Greece has been constantly referred to for the period of history comprised in the work of Thucydides.

Respectfully submitted,

HENRY DRISLER,

*Jay-Professor of Greek.*

Columbia College, May 1, 1888.

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#### DEPARTMENT OF LATIN.

*To the President of Columbia College :*

The undersigned has the honor to present the following report of the work of the department during the college year now ending.

(1) *Graduate Students.*—Five graduate students were entered in this department at the beginning of the first term, one of them being compelled to discontinue his studies almost immediately by reason of a change of residence. The remaining members of the class attended the undersigned regularly throughout the year. During the first term the Tragic Fragments of Livius Andronicus and Nævius were translated with a commentary given in the form of lectures, and embodying a critical discussion of the text, with especial reference to the forms of early Latin, the history of the early Roman drama, and the peculiarities of the archaic diction. During the second term, the members of the class met once a week as a seminary, for the discussion and elucidation of the Ennian fragments, including those of Prætextæ. Much original work was done in this way, in the domain of textual criticism and comparative

syntax. The undersigned also lectured on many incidental questions of philological and archæological importance. On finishing the Ennius, the class read rapidly some hundred inscriptions from the earlier Latin with a running commentary on epigraphy and historical grammar. Throughout the entire year, the graduates also met once each week for the reading and exposition of Lucretius. Three books of the *De Rerum Natura* were thus read, with a critical study of the Epicurean philosophy as expounded by the ancient philosophers themselves. The texts of Bernayo, Lachmann, and Munro were likewise compared and the merits of the various readings discussed. The class read privately as supplementing their regular work the essential portions of the Epicurean exposition contained in the treatise of Cicero *De Natura Deorum* (Bk. I.).

(2) *Senior Class*.—Thirty-four members of the Senior Class elected one or more courses of Latin. Of these, nineteen read with the undersigned during the first term the whole of the *Mostellaria* of Plautus with a critical study of the comic prosody, the archaic forms, and the early syntax. Much information concerning the early Roman drama was also imparted by lecture and otherwise. During the second term, this division of the class read thirty chapters of the Second Book of Cicero *De Natura Deorum*, containing an exposition of the Stoic theories. Twenty students elected a third hour of Latin for the especial study of the Inscriptions. With this class, the undersigned read one hundred and sixty-six inscriptions and fragments of the earliest existing Latin, including the *Leges Regiæ*, the *Columna Rostrata*, the *Carmen Saliare*, the *Carmen Arvalem Fratrum*, and the *Senatus Consultum de Bacchanalibus*, all being accompanied with appropriate commentary. Fourteen students elected a fourth hour of Latin for the rapid reading of Latin at sight, and during the year finished the entire volume of Ramsay's *Selections from Ovid* (113 pages); and in prose, the First Book of the *Institutes of Gaius*—the reading of the latter being supplemented by explanatory lectures.

(3) *Junior Class*.—During the two hours per week required of all the members of the class, the First, Third, Eighth, Tenth, and Sixteenth Satires of Juvenal were read in the first term ; and the class received practical instruction in verse composition. Very rapid improvement was noticed in facility of expression and in a correct appreciation of syllabic quantity ; and several members of the class showed much readiness in writing hexameter verse. During the second term some thirty-five chapters of the First Book of Cicero's Tusculan Disputations were read carefully, and several lectures were given by the undersigned, on the historical development of Roman satire and on the philosophy of Cicero, particular importance being given to the views of the Middle Academy. Eighteen students elected a third hour of Latin, in which the entire *Audrian* of Terence was read as well as the whole First Book of Lucan's *Pharsalia*.

(4) *Sophomore Class*.—This class, in three sections, attended Dr. H. A. Short three hours each week. The reading of the first term consisted of the First Book of the Satires of Horace and selections from the First Book of the Epistles. The subject of etymology received especial attention. During the second term, forty chapters of Livy (Bk. XXI.) were read, with occasional exercises in prose composition. Lectures were given during the year upon Roman antiquities, the Latin hexameter, and other subjects relating to the elucidation of the text.

(5) *Freshman Class*.—In four sections, the class attended Mr. N. G. McCrea two hours, and Dr. H. A. Short for one hour, each week. The *Ars Poetica* and Book I. of the Odes of Horace were read in the first term, and the *De Senectute* and twenty chapters of the *De Amicitia* of Cicero, in the second term. The subject of prosody was also thoroughly reviewed ; and, likewise, the syntax of the moods was made a topic for special study. With Dr. Short, the class received during the second term a thorough drill in the subject of Latin prose composition.

(6) *Sight-Reading*.—In addition to the regular work of the department, a volunteer class of thirteen members of

the Sophomore and Freshman Classes met Mr. Charles Knapp, the Fellow in Latin, once each week during the first term, and twice each week during the second term, for the reading of Latin at sight. In this way, the First Book of Livy, and thirty letters of Pliny the Younger were read, with a very marked increase in the facility of sight translation.

(7) Two lectures were delivered by the undersigned before the members of the School of Library Economy, on the Bibliography of the Latin Language and Literature, including also a consideration of the standard works upon Roman history, art, and archæology.

Respectfully submitted,

H. T. PECK,

*In Charge of the Department of Latin.*

Columbia College, May 1, 1888.

*DEPARTMENT OF MATHEMATICS, MECHANICS,  
AND ASTRONOMY.*

*To the President of Columbia College :*

I have the honor to report that the courses of study in this department have been carried on in accordance with the scheme prescribed by the Board of Trustees, as laid down in the Handbook of Information.

SENIOR CLASS.

*Descriptive Astronomy.*—This course has been elected by thirty out of a class of forty-five. These students have attended me twice a week throughout the year. Instruction has been given by means of a text-book supplemented by an extended course of illustrated lectures. The progress of the class has been tested by frequent written examinations with satisfactory results.

*Differential and Integral Calculus.*—This course has been elected by five students, or eleven per cent. of the entire senior class. As the course is only chosen by those who have a natural aptitude for mathematical studies, the prog-

ress of the class has been rapid and satisfactory. An attendance of two hours per week throughout the year has sufficed to cover the entire ground prescribed, which is sufficiently extensive to enable those who have gone over it to enter upon the study of any branch of mathematical science. Long experience has convinced me that no more than ten to twelve per cent. of average college students have a decided taste for mathematical studies.

#### JUNIOR CLASS.

*Analytical Geometry and Mechanics.*—This course has been elected by fourteen students, or exactly one-third of the class. These students have attended me three times a week throughout the year, studying Analytical Geometry the first term, and Mechanics the second term. The methods of instruction have been the same as were pursued last year, for which I beg leave to refer to my report of 1886-7.

#### GRADUATE INSTRUCTION.

The courses of Graduate Instruction are intended to cover two years. During the course of the first year instruction is given in Determinants and Modern Co-ordinate Geometry, and during the course of instruction in the second year the subject is Higher Mechanics. During the current year five names have been enrolled, but in consequence of the withdrawal of one student, only four have continued to the end of the year. Much has been accomplished, but there is room for advance. It seems desirable that the courses of Graduate Instruction in this department and in the department of Pure Mathematics should be embraced in a single scheme, and that wider publicity should be given to the united course.

#### ASSISTANCE.

Mr. Lincoln Cromwell, a prize Fellow, has been assigned to this department, and it is due to him to say that he has shown great zeal and ability in the discharge of his duty. He has aided me in reading the numerous examination papers, in the exhibition of the lantern illustrations, and in

the preparation of experiments shown in the college class, and also to School of Mines class in Mechanics.

Respectfully submitted,

Wm. G. PECK,

*Professor of Mathematics and Astronomy.*

Columbia College, April 9, 1888.

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### DEPARTMENT OF MATHEMATICS.

*To the President of the Columbia College :*

I have the honor to report that, during the past year, the freshman and sophomore classes have attended in mathematics as follows :

The Freshman class—four times in sections and once as a class, in all five times.

The Sophomore class—once in sections and twice as a class, in all three times per week ;

and have accomplished the prescribed course of study. In addition to the course set forth in the Handbook of Information, the freshman class has had instruction in the elements of determinants—an addition made tentatively last year with your permission, and, proving of decided interest and advantage, now made part of the regular course.

During the second term, Adjunct Professor Goodwin has had, for two hours per week, a volunteer class for the study of graphic algebra as illustrating and enforcing the general theory of equations. The class has proved a decided success.

The examination for prize scholarships will be upon the work of the year with the addition, for the freshman class, of higher algebra as contained in Davies' Bourdon, and, for the sophomore class, of extra work in series, the doctrine of limits, imaginary quantities, and trigonometric developments.

There have been this year two classes in graduate mathematics, representing respectively the first and third years of this course. The latter class has consisted of two members,



Messrs. Fiske and Stabler. They have been required to expound and defend in detail the original dissertations which they have presented in fulfilment of one of the requirements for the degree of Doctor of Philosophy. In connection with the studies of this class, it has been found profitable to assign subjects for a number of lectures by its members. Mr. Fiske, for example, has delivered, in this way, two lectures on the fundamental theory of elliptic functions. The first year graduate class has been conducted by Mr. Stabler under my personal supervision. In it has been given an extended course in higher calculus based upon a thorough and complete study of Williamson's Differential and Integral Calculus. Exceptional ability has been exhibited by Mr. Gilman of this class.

Respectfully submitted,

J. H. VAN AMRINGE,

*Professor of Mathematics.*

Columbia College, May 2, 1888.

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#### DEPARTMENT OF PHYSICS.

*To the President of Columbia College :*

The following is the report of the work done in my department of the School of Arts during the year :

##### JUNIOR CLASS.

During the first term the junior class was engaged for two hours per week on the subject of sound, embracing : Nature of sound-waves ; velocity through gases, liquids, and solids ; reflection of sound ; refraction ; interference ; measurement of wave-lengths ; measurement of number of vibrations ; vibrations of strings ; musical scale ; vibrations of rods, plates, and bells ; organ-pipes ; flute pipes ; reed pipes ; vibrations of tuning-forks determined with the chronograph ; Lissajous' experiments ; resonance ; human voice ; the ear and audition ; telephone ; phonograph ; etc.

During the second term two hours per week upon the subject of heat : expansion of solids, liquids, and gases ;

mercurial and air thermometers; maximum and minimum thermometers; conduction of heat by solids, liquids, and gases; tension of vapors; high- and low-pressure steam engines; radiant heat; latent heat of liquids and gases; specific heat; etc.

#### SENIOR CLASS.

This class occupied three hours per week during the first term in studying the subject of light: Transmission, velocity, and intensity of light; photometers; reflection of light; plane, concave, and convex mirrors; spherical aberration; refraction by plates and prisms; total reflection; dispersion by prisms; spectroscope; chemical and solar lines; lines from fixed stars; lenses, convex and concave; achromatism; camera-obscura; simple and compound microscopes; astronomical and terrestrial telescopes; the eye and vision; etc.

During the second term three hours per week upon the study of sound, the subjects being the same as those given to the junior class.

#### ELECTIVE STUDIES WITH SENIORS.

These were engaged during the first term two hours per week as follows: Mechanical theory of heat; determination of the mechanical equivalent of heat; conversion of heat into work; application of steam-engines; indicator diagrams; elasticity of gases; isothermals of gases and steam; adiabatics; Carnot's engine; reversible engines; caloric engines and steam engines compared; absolute temperature; kinetic theory of gases; etc. Electrostatics; determination of the constants of a battery; measurements of resistance; Wheatstone bridge; etc.

During the second term two hours per week as follows: Absolute units; C. G. S. system; practical electrical units; theory of dynamo-electric machines; electric lighting; arc and incandescent systems; etc.

Undulatory theory of light; propagation of light by waves; reflection of light; refraction of light; total reflection; interference of light; Fresnel's experiments; New-

ton's rings explained by the undulatory theory of light ; thin plates ; thick plates explained by the undulatory theory in the same manner ; double refraction in uniaxial and biaxial crystals ; conical refraction ; plane polarization ; circular polarization ; rotary polarization ; etc.

The circumstance that the Junior and Senior classes both were occupied with the subject of sound (separate courses of lectures) was due to a change in the order of their studies, which in the future will be :

Junior year, first term, Sound ; second term, Heat.

Senior year, first term, Electricity ; second term, Light.

Respectfully submitted,

O. N. ROOD,  
*Professor of Physics.*

Columbia College, May 1, 1888.

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*DEPARTMENT OF HISTORY AND POLITICAL  
SCIENCE.*

*To the President of Columbia College :*

In the department of History in the School of Arts, the sophomore class has been taught, two hours per week, in three divisions, by Dr. Dunning and Mr. Goodnow, in the elements of universal history. The class has been occupied during the entire year in this study.

The junior class has been taught a continuation of the same study, two hours per week, during the first term, by Adj. Prof. Munroe Smith.

The senior class has been taught, two hours per week, during the entire year, in the Constitutional History of England, by Prof. R. M. Smith, and four hours per week during the entire year in the Constitutional History of Continental Europe and of the United States, by the head of the department.

Respectfully submitted,

JOHN W. BURGESS,  
*Professor of History and Political Science.*

Columbia College, May 1, 1888.

*DEPARTMENT OF PHILOSOPHY, ETHICS, AND  
PSYCHOLOGY.*

*To the President of Columbia College :*

The following elective courses have been given to the members of the senior class during the last academic year :

I. On the general History of Philosophy, two hours per week.

II. On Psychology (by lecture and text-book), one hour per week.

III. On Ethics, during the first term, Calderwood's Hand-book, one hour per week ; lectures on Contemporary English Ethics, one hour per week. During the second term, lectures on the Ethics of Pessimism, one hour per week ; lectures on Contemporary English Ethics, one hour per week.

The following courses of lectures have been given to graduate students :

I. On the Post-Kantian Philosophy : during the first term, one hour per week ; during the second term, two hours per week.

II. On English Ethics, one hour per week.

All the courses named above have been given by the Professor of Philosophy. The *Seminar* has held weekly meetings under the direction of Dr. Butler. A report of the work in department is given below.

The junior class has been instructed in Logic by Dr. Dunning, one hour per week. This class has met in sections.

Respectfully submitted,

ARCHIBALD ALEXANDER,

*Professor of Philosophy, Ethics, and Psychology.*

Columbia College, May 1, 1888.

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*REPORT ON THE PHILOSOPHICAL SEMINAR.*

*To Archibald Alexander, Ph. D., Professor of Philosophy,  
Ethics, and Psychology :*

The growth of the Philosophical Seminar and its increasing importance in the work of the graduated students are most encouraging. They conclusively demonstrate not

only that the time has come when Columbia College can expect to attract advanced students in considerable numbers, but also that the importance of original investigation and research in philosophy is appreciated as it has not been before. The membership of the Seminar during the year has been fifteen, and the average attendance at the weekly two-hour sessions has been over thirteen. The department of philosophy may point with pardonable pride to the fact that 45½ per cent. of the total number of graduate students enrolled in all the departments are in attendance at its Seminar. Of the fifteen members, six hold the degree of B.A. from Columbia, and nine hold the same degree from other institutions. Five of the students are Masters of Arts.

The specific work of the first half of the year was the critical explanation and analysis of Kant's *Kritik der reinen Vernunft*. At present the Seminar is engaged in the study of psychological problems by the comparative method. Special topics have also been assigned to individual students for investigation and report, and each student has in addition submitted a digest and a criticism of some philosophical topic or book that is attracting attention at this time. As to the character of these reports and criticisms I am glad to be able to repeat my comment of last year, namely, that many of them are indicative of marked philosophical ability on the part of their authors. The books and subjects specifically assigned and reported on have been as follows:

Mr. Cohen—Bowne's Introduction to Psychological Theory.

Mr. Wellwood—Fowler's Principles of Morals.

Mr. R. I. B. Illman—McCosh's Psychology.

Mr. Dows: Guyau's *La Morale Anglaise Contemporaine*.

Mr. Nies: Max Müller's Science of Thought.

Mr. Grint: Courtney's Constructive Ethics.

Mr. Carhart: Schurman's Ethical Import of Darwinism.

Mr. Lovenry: Lotze's Outlines.

Mr. Harrison: Giordano Bruno.

Mr. Brown: Vico.

Mr. Linehan; Fichte's Science of Knowledge.

Mr. G. F. Illman: Harris' Philosophical Basis of Theism,

Mr. Leipziger : The Psychological Basis of Pedagogy.

Mr. Fairbanks : Carrau's *La Philosophie Religieuse en Angleterre*.

Minor papers have also been presented on Prof. William James' theory of space and time, Prof. William James' theory of the will, the effect of the scientific temper on modern poetry, Dr. Maudsley on the physical conditions of circumstances, and The Philosophy of Wundt.

At the close of the present term a number of candidates will present themselves for the examination for the degree of Doctor of Philosophy.

Another year's experience has deepened my conviction that two or more scholarships of \$250 each should be established, to be held for one year by students selected by the Faculty, on condition that they pursue a graduate course in philosophy and undertake some original investigation. The influence of the Seminar would be greatly increased and its work more effective if some provision were made by the Trustees for the publication of the best papers presented during the year. An appropriation of \$300 annually would be sufficient and I urgently request that it be applied for. The printing of the results of research is an obvious and necessary adjunct of university work.

The junior class has attended in two sections, one hour a week each, in Logic. The instruction has been given partly by text-book and partly by lecture, and has embraced Deductive Logic, Inductive Logic, and Scientific Method.

Respectfully submitted,

NICHOLAS MURRAY BUTLER,

*Tutor in Philosophy, Ethics, and Psychology.*

Columbia College, April 5, 1888.

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## *DEPARTMENT OF POLITICAL ECONOMY AND SOCIAL SCIENCE.*

*To the President of Columbia College :*

In the department of Political Economy and Social Sci-

ence I have the honor to report that the following work has been done :

In the School of Arts, the junior class has been instructed in the principles of Political Economy, two hours per week during the second term, using Walker's Political Economy as a text-book.

The senior class (an elective division) has listened to lectures four hours per week throughout the year on Historical and Practical Political Economy.

Respectfully submitted,

RICHMOND M. SMITH,

*Professor of Political Economy and Social Science.*

Columbia College, May 1, 1888.

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#### DEPARTMENT OF THE ENGLISH LANGUAGE AND LITERATURE.

*To the President of Columbia College :*

I beg leave to make the following report upon the work done, during the session of 1887-88, in the department of English :

There has been no break in the work either from sickness or from any other cause. The duties assigned to each instructor have been done with regularity and faithfulness.

The freshman class has, during both terms, been each week once with me and twice with Dr. Quackenbos. With me it has studied the logical analysis and syntax of the language, and it has read the poetry of Tennyson, with minute examination of grammar and style. With Dr. Quackenbos, it has studied the elements of rhetoric and composition and the history of literature, and it has written monthly exercises.

The sophomore class has been twice with Dr. Quackenbos each week, and once with Dr. Carpenter, who, during the absence of Dr. Jackson, the regular assistant in English, has given his valuable aid to my department. With Dr. Quackenbos, this class has carried on its study of rhetoric and of the history of literature, and has written monthly

exercises. With Dr. Carpenter it has studied the historical grammar, and read Shakespeare's, Othello, with minute examination of language, thought, and plot.

The junior class has been each week twice with me and once with Dr. Carpenter. With me the class has studied the higher rhetoric, chiefly the formation of sentence and paragraph in prose, and the philosophy of literature and criticism, with especial regard for Bacon and Milton, whose works we have studied. With Dr. Carpenter, it has studied Anglo-Saxon grammar, and begun the reading of Anglo-Saxon. For practice in composition, the class has written every two or three weeks essays on literary subjects.

The senior class has been twice each week with me. It has studied the higher theory of composition, chiefly the construction and arrangement of discourse, the historical grammar, including Anglo-Saxon and Early English, and the principles of English verse-form and prosody. It has read with me Anglo-Saxon poetry and the poetry of Chaucer. And, for practice in composition, it has written every two or three weeks essays in description, narrative, and exposition.

A class of three young men, all graduates, has carried on with me a regular course of graduate studies, coming to me twice each week. Their study has been for this year in the historical development of the English prose from the 12th century to the 17th—with minute examination of chief prose writers in order of time. They have worked with much spirit and have made much progress.

I beg, finally, to commend to you the admirable work done for this department by Messrs. Dodge and Wasson, Fellows of the college.

I enclose reports from Dr. Quackebos and from Dr. Carpenter on the work done by each.

Respectfully submitted,

THOMAS R. PRICE,

*Professor of the English Language and Literature.*

Columbia College, May 23, 1888.



*SPECIAL REPORT ON ENGLISH LITERATURE  
AND RHETORIC.*

*To Professor Thomas R. Price :*

During the past college year, the freshman class has been instructed, largely by lecture, in the principles of rhetoric and prose composition, which have been fully illustrated by practical examples. The plan of daily written recitations on the blackboard has been pursued, as heretofore, and with the same satisfactory results. Each student has further been required to present an essay on the first of every month; the exercises have been carefully criticised, and the corrections explained to the several authors.

The class has also received instruction by lecture in the history of English literature. Its members have been required to study, under the supervision of the adjunct professor, in the library, the various authors treated of in the classroom; as well as to construct their own note-books, embodying illustrative extracts. These note-books are examined from time to time, and proficiency in the subject is made conditional upon their faithful preparation.

The sophomore class has been similarly instructed in the essential elements of style, and in the history of English literature, especially the dramatic poetry of the Elizabethan period.

Respectfully submitted,

JOHN D. QUACKENBOS,

*Adjunct Professor of English.*

Columbia College, April 24, 1888.

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*SPECIAL REPORT ON ENGLISH AND ANGLO-  
SAXON.*

*To Professor Thomas R. Price :*

To the three sections of the sophomore class, instruction has been given, three hours weekly, in the history of the English language. During the first term the history of inflections was studied; during the second, the general

history of the language. In addition to this Shakespeare's *Othello* has been critically read with reference to plot, vocabulary, and syntax.

To the two sections of the junior class, instruction has been given in Anglo-Saxon, two hours weekly throughout the year. The paradigms, syntax, and phonetics in Sweet's *Anglo-Saxon Primer* have been carefully studied, and a sufficient quantity of the text has been read to apply practically the knowledge of the grammar.

To five members of the senior class, instruction of a more advanced character has been given in Anglo-Saxon, two hours weekly. In Sweet's *Anglo-Saxon Reader*, numerous prose and poetical extracts have been read; and inflections, phonetics, and syntax, not alone of Anglo-Saxon, but of the related languages, have been constantly considered and commented upon.

Respectfully submitted,

WM. H. CARPENTER,

*Acting Instructor in Anglo-Saxon.*

Columbia College, April 25, 1888.

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## DEPARTMENT OF MODERN LANGUAGES AND FOREIGN LITERATURE.

*To the President of Columbia College:*

The work in the department under my charge has progressed along essentially the same lines as in preceding years, and the results attained have been equally satisfactory. I have only to chronicle the introduction of one new department of study, viz: "Comparative Literature." The detailed report of the several sections is as follows:

### *Germanic Department.*

FIRST YEAR (Dr. Carpenter).—Thirty-eight students, in two sections, two hours each. Work: Whitney's *Brief German Grammar*. (April 5th) Twenty-eight pages of Otis' "Grimm's *Maerchen*." Weekly exercises in translation from English.

SECOND YEAR.—Twenty-seven students, in two sections, two hours each (three hours Prof. Boyesen, one hour Dr. Carpenter). Work: sixty to seventy pages of Heine's Prose; thirty pages of Swiss Family Robinson translated into German. Weekly written themes for translation into German.

THIRD YEAR (Prof. Sprague Smith).—Nineteen students, one section, two hours. Work: class reading; Schiller's Thirty Years' War, forty pages; and Maria Stuart entire. Sight-reading from Grimm's Maerchen and Heyse's "*Am todten See*." During first term written *resumés* at each recitation of work of preceding. Outside reading (five hundred pages octavo) with two essays. A few lectures in German have been given to this class.

FOURTH YEAR (Prof. Boyesen).—Eighteen students, one section, two hours. Work: Goethe's Faust, first part entire, and more important portions of second part. As commentary, chapters on Faust in Boyesen's "Goethe and Schiller."

#### *Lectures.*

*Literature* (Prof. Boyesen).—Fifteen students, one hour a week. Work: entire field from earliest monuments to present.

*Philology* (Dr. Carpenter).—Two students, one hour a week.

*Voluntary Classes.*—Conversation and compositions (Prof. Boyesen), sixteen students, two hours a week.

*Third Year extra* (Prof. Sprague Smith).—Five students, one hour a week, sight-reading.

*Danish* (Prof. Boyesen).—One student, one hour a week. Selections from modern Danish and Norwegian literature, illustrated by informal lectures.

*Icelandic* (Dr. Carpenter).—One student, two hours a week.

*Graduate Instruction* (Dr. Carpenter).—Two hours a week, one student in Icelandic Philology and Middle High German and general Teutonic Philology.

*Romance Department.*

*French*—FIRST YEAR.—Two sections, two hours each.

Section A (Prof. Sprague Smith).—Seventeen students. Work: Chardenal's First French Course; about eighty pages from *La Belle Nivernaise* (Daudet) and other extracts. A few students of this section during the second term have devoted an extra hour to reading "*La Mère de la Marquise*."

Section B (Mr. Scribner).—Twenty-eight students. Work: Chardenal's First French Course, and about one hundred and sixty pages from O'Connor's "*Choix de Contes Contemporains*."

SECOND YEAR. (Dr. O'Connor).—Thirty-three students, two sections, two hours each. Work: Chardenal's Second French Course; *Le Buste* (About), and extracts from other works, in all about one hundred and fifty pages.

*Lectures on Literature* (Mr. Scribner).

I. From origin to end of seventeenth century. Fifteen students, two hours a week. Readings from leading authors of the seventeenth century.

II. Eighteenth and nineteenth centuries. Eighteen students, two hours a week. Works read; *Laire, La Grandeur et Décadence des Romains, La Peau de Chagrin, Paul et Virginie*.

III. Special course (in French). Thirty-six students, two hours a week. In connection with lectures writing of essays and criticism of works read, namely: *La Grandeur et Décadence des Romains, Le Contrat Social, Laire, Paul et Virginie, Le Discours sur la Banqueroute*.

THIRD YEAR (Dr. O'Connor).—Three students, two hours a week. Work: Three modern comedies: *Le Monde où l'on s'ennuie, Le Testament de César Girodot, Le Gendre de M. Poirier*. Classic drama: *Le Cid*, and Molière's *Misanthrope*. Outside reading to the extent of six hundred pages, with twelve essays in French on works read.

FOURTH YEAR (Dr. O'Connor).—Philological. Ten students, two hours a week. Lectures on French historical

grammar, and about one thousand lines of *Chanson de Roland*.

FOURTH YEAR (Mr. Scribner).—Literary. Four students, two hours a week. Work: Conversation and composition. Reading: *L'Essai sur les Mœurs* (Voltaire); *Le Contrat Social* (J. J. Rousseau); *Hernani* (Victor Hugo).

#### *Lectures.*

For philology, see First Year (Dr. O'Connor).

*Italian* (Mr. Clover).—FIRST YEAR.—Six students. Sauer's Italian Grammar; Montague's Italian Literature; and Goldoni's *Pamela Nubile*. This class has also listened to a course of lectures in Italian on the "Life and Works of Petrarch." Conversation introduced.

SECOND YEAR.—Six students. Dante's *Inferno* critically studied. A course of lectures given to this class on the history of Italian literature from the beginning to close of classical period.

*Spanish*.—FIRST YEAR.—Six Students (one hour Prof. Sprague Smith, and one hour Mr. Clover). Work: Josse's Grammar; about thirty-five pages of Montilla's *Libro de Lectura*, and about forty pages of *Clemencia* (F. Caballero).

SECOND YEAR (Mr. Clover).—Two students; two hours weekly. Work: sixty pages of *Don Quijote* and Calderon's *La Vida es Suero*.

A course of lectures (two hours a week) in Spanish, on the life and works of Cervantes, has been given, to which students of both classes have been admitted, and conversation has also been introduced in both years.

#### *Graduate Work.*

*Romance Department*.—Philological.—One student; two hours a week. Work: Provençal, grammar, and extracts from earlier Troubadours. Old French Syntax. Critical study of *Chanson de Roland*.

COMPARATIVE LITERATURE (Prof. Sprague Smith).—Two students; two hours a week. One hour devoted to lectures on the Philosophy of Literature; the second, lec-

tures to a comparative study of the early epics of modern Europe. Extracts read from *Cid* poems, *Chanson de Roland*, *Nibelungen Lied*, the Poetic *Edda*, and the Icelandic *Saga*.

Respectfully submitted,

CHARLES SPRAGUE SMITH,

*Professor of Modern Languages and Literature.*

Columbia College, April 16, 1888.

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DEPARTMENT OF GEODESY AND PRACTICAL  
ASTRONOMY.

*To the President of Columbia College :*

I have the honor to report as follows :

1. *The First Year Post-Graduate Class* in Practical Astronomy (two students) has done considerable work in the Observatory besides attending one hour a week for lectures and explanations. By the end of the term the class will have worked out several sets of transit observations for time, and zenith telescope observations for latitude, both by method of least squares.

2. *The Senior Class* (elective, two students) in Practical Astronomy has met me twice a week for lectures and explanations, and has done a creditable amount of work in the Observatory. Most of the time has been spent on sextant observations for time, latitude, and longitude, and on the general use of, and simple reduction of observations with, the transit instrument for the time errors of the clock and the constants of the instrument.

3. *The Senior Class* (optional, six students) in Navigation has met me twice a week for lectures, and has made numerous observations with sextant, using only sea methods. The text-books used are Bowditch's Practical Navigator, Coffin's Navigation and Nautical Astronomy, and Chauvenet's Spherical and Practical Astronomy.

4. The Observatory, under the care of Mr. Allen, has

been open on many clear nights to students and other visitors.

Respectfully submitted,

J. K. REES,

*Professor of Geodesy and Practical Astronomy.*

Columbia College, May, 1888.

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#### DEPARTMENT OF CHEMISTRY.

*To the President of Calumbia College :*

I have the honor to report that in the Academic Department of the college I have met the sophomore class once a week during the past year, and have given instruction on the non-metallic elements and their compounds, including the chemistry of the atmosphere and composition of water. I find the amount of time allotted to me for this purpose entirely inadequate. Between the hours taken for examination, and the hours lost by holidays and vacations, I have, on the whole, a very small number of lectures. As it has always been the intention to have the sophomore students well prepared for admission to the School of Mines, it seems desirable that they should be well grounded in the chemistry of the non-metallic elements, and I would respectfully suggest that an allotment of two hours a week would enable me to much more than double the usefulness of this course of instruction. Although the class has been very attentive and regular, it is still difficult to keep up the interest when the exercises come only once a week.

The portion of the senior class which elected chemistry has attended two lectures a week. During the first session, the subject studied was the chemistry of the metals. In addition to the lectures, the members of the class have had a weekly recitation, which was held by Dr. Wiechmann, Instructor in Chemical Philosophy and Chemical Physics. The progress made by the class has been entirely satisfactory.

Respectfully submitted,

C. F. CHANDLER,

*Professor of Chemistry.*

Columbia College, April 13, 1888.

*DEPARTMENT OF GEOLOGY.*

*To the President of Columbia College :*

I have the honor to make the following brief report on the work done in the departments of Geology, Economic Geology, Botany, and Zoölogy, in the School of Arts and School of Mines.

Lectures have been delivered as follows :

1. Three times per week, in Economic Geology, to the fourth-year class in the School of Mines.
2. In Systematic Geology, three times per week, to the students of the third-year class of the School of Mines.
3. In Systematic Geology, once a week, to the third-year architectural class, and a small number of seniors in the Academic Department who have taken Geology as an elective study.

Laboratory practice has been given to the third-year class of the School of Mines in Microscopic Lithology by Mr. F. J. H. Merrill, who holds a Fellowship in the department of Geology, one hour per week during a term of sixteen weeks.

Mr. John I. Northrop, Fellow in Geology, has given laboratory instruction in Palæontology two hours per week throughout the year.

The aggregate number of lectures and laboratory exercises will, at the end of the academic year, have amounted to about two hundred and eighty in Geology and Economic Geology.

Instruction in Botany and Zoölogy, as well as the care of the Herbarium, have been, as last year, intrusted to Dr. N. L. Britton, whose report of work done in his department is enclosed herewith.

Work in the museum has been constantly done by Mr. Merrill and Mr. Northrop, and, since his appointment, by Mr. B. C. Laraway. This work has consisted mainly in rearranging and relabelling the specimens, in order to make the museum more attractive and instructive. About one-half of the specimens have been reviewed in this way, and



the museum now presents an appearance which may well make it an object of satisfaction and pride to all the friends of the college.

The additions to the museum since June 30, 1887, have been 954 specimens, amounting in value to \$1,039.

Respectfully submitted,

JOHN S. NEWBERRY,

*Professor of Geology and Palæontology.*

Columbia College, April 16, 1888.

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*REPORT ON THE SUB-DEPARTMENT OF  
BOTANY.*

*To Professor J. S. Newberry :*

I have the honor to submit the following report on the sub-departments of Botany and Zoölogy.

Instruction in Botany has been given by me during the past year as follows :

To the second-year class in the School of Mines in lectures one hour per week, and these lectures have been delivered also to the first-year class in the same school, owing to the transferral of Botany from the second to the first year ; to an elective and optional section of the junior class in the School of Arts, numbering twenty-one students, in lectures one hour per week ; and to an elective section of the senior class, School of Arts, numbering thirteen students, in laboratory practice in histology and morphology, one hour per week, though from the interference with other electives I have met this class at two different hours. I have also lectured to the School of Library Economy and furnished desired botanical information to other students and graduates.

The care of the Herbarium has required nearly all the remainder of my time, and I am gratified in being able to state that, for the first time in more than ten years this great collection is systematically arranged and in good working order. It is constantly becoming of greater value. A large

number of specimens accumulated in former years have been mounted and properly distributed in the cases, and the additions during the past year number about 8,000.

My original studies have been mainly devoted to the elaboration of the large South American Collections made by Dr. H. H. Rusby, and this work is now approaching completion. Dr. Rusby has joined me in the publication of *A List of Plants, Collected by Miss Mary B Croft at San Diego, Texas*, and I have also written papers on *An Archæan Plant from the White Crystalline Limestone of Sussex County, New Jersey* and *On New or Noteworthy North American Phanerogamia I*.

The instruction in Zoölogy has consisted in a course of lectures, one hour per week, to a part of the second-year class in the School of Mines. During the year repeated requests have been made from Seniors and Juniors in the School of Arts for an elective course in this subject.

Respectfully submitted,

N. L. BRITTON,

*Instructor.*

## REPORT ON SANSKRIT.

*To the President of Columbia College :*

I have the honor to present the following report upon the instruction in Sanskrit which I have given during the college year now ending.

Owing to the absence of Professor Merriam in Greece, the charge of the Sophomores in Greek devolved upon me ; and I have had partial charge also of the Freshman Greek, which made in all eleven hours per week with my Greek classes. This made it impossible for me to devote as many hours to my instruction in Sanskrit as I should otherwise have done ; a beginner's class which I had planned, and for which several candidates had offered themselves, was given up because it was not possible for me to arrange the hours in harmony with the required hours of the candidates.

I have, however, given four hours per week of Sanskrit throughout the year—three with a graduate student who wished to make a beginning in that study. The progress of the advanced student has been very great; we have read a considerable amount of Verdic Sanskrit, and I have lectured to him on Sanskrit Literature.

Respectfully submitted,

EDWARD DELAVAN PERRY,

*Instructor in Sanskrit.*

Columbia College, April 6, 1888.

### REPORT ON HEBREW.

*To the President of Columbia College :*

I have the honor to report as follows upon the instruction given in the Hebrew language during the present year.

In advanced Hebrew one member of the Senior class and one of the Graduate Department have attended me throughout both terms during four hours of the week. With the first gentleman I have read the first ten chapters of Genesis, the whole of Hosea and Micah, special attention having been paid to the philological and textual criticism. With the second gentleman I have read selected portions of Genesis, Proverbs, and Psalms.

One member of the Junior class has taken a course in Biblical Aramaic with me twice a week throughout both terms. A careful study was made of Kautzsch's "Grammatik des Biblisch-Aramaischen," and of the first eight chapters of the Book of Daniel.

At the beginning of the second term two classes in Elementary Hebrew were started. The first class was attended by one member of the School of Law, who had studied carefully the principles of the Grammar, and has read the first six chapters of the Book of Samuel. The second class was attended by three members of the Freshman class and by one Senior. The first twenty-four lessons

in Harper's "Introductory Hebrew Method and Manual," in conjunction with Harper's "Elements of Hebrew," have been carefully studied. The class has also brought in once a week a written translation from English into Hebrew.

Three gentlemen have attended me twice a week during both terms in a course on Rabbinical Hebrew. Two treatises of the Mishnah, "Makkoth" and "Sanhedrin," bearing on the constitution and functions of the Sanhedrin, have been carefully studied, special attention having been paid to the historical bearing of the matter dealt with.

Respectfully submitted,

RICHARD J. H. GOTTHEIL,  
*Professor of Rabbinical Hebrew and Lecturer on the  
Syriac Language.*

Columbia College, April 10, 1888.

**APPENDIX B.**

**SCHOOL OF MINES.**

**REPORT ON THE GENERAL STATE OF THE SCHOOL BY THE  
DEAN OF THE FACULTY.**

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*To the President of Columbia College :*

I have the honor to report that the twenty-fourth annual session of the School of Mines, now about to close, has been in every respect satisfactory.

On last Commencement day fifty-four diplomas were issued to graduates of the School of Mines, as follows :

In Mining Engineering (E.M.).....	22
Civil Engineering (C.E.).....	13
Metallurgy (Met. Eng.).....	2
Analytical and Applied Chemistry (Ph.B.).....	10
Architecture (Ph.B.).....	4
Doctor of Philosophy (Ph.D.).....	3
	<hr/>
	54

In addition to the foregoing diplomas official mention was made at Commencement of two diplomas (one in Mining Engineering and one in Civil Engineering) which had been granted during the year.

Since last Commencement the degree of Bachelor of Philosophy in the course of Analytical and Applied Chemistry, has been granted to a member of the class of 1887, who had not previously complied with all the requirements. Also, since last Commencement, the degree of Doctor of Philosophy was awarded to a graduate of the school.

During the past year two hundred and forty-three (243)

students have been in attendance on the exercises of the School of Mines, distributed as follows :

First Class.....	58
Second " .....	72
Third " .....	56
Fourth " .....	42
Post-Graduates.....	15
<hr/>	
Regular students.....	243
Post-Graduates from the School of Arts.....	5
Summer School in Chemistry.....	48
<hr/>	
	296
Deduct students in Summer School counted in classes above.....	30
<hr/>	
Total students in attendance.....	266

The regular students have pursued the different courses of the School of Mines as follows :

	First Class.	Second Class.	Third Class.	Fourth Class.	Post- Grad.	Total
Mining Eng.....	12	10	14	5	1	42
Civil Eng.....	27	26	22	13	3	91
Metallurgy .....	—	6	—	2	—	8
Geology and Palæontology....	2	—	2	—	—	2
Anal. and App. Chemistry....	11	5	6	15	—	37
Architecture.....	8	25	12	7	1	53
Sanitary Eng.....	—	—	—	—	2	2
Doctor of Philosophy.....	—	—	—	—	7	7
Miscellaneous .....	—	—	—	—	1	1
<hr/>						
Total.....	58	72	56	42	15	243

The Graduating Class numbers forty-two, distributed among the parallel courses as follows :

In Mining Engineering.....	5
Civil Engineering.....	13
Metallurgy .....	2

Analytical and Applied Chemistry.....	15
Architecture .....	7
	<hr/> 42

It is impossible to say at this time how large a proportion of the class will be able to graduate at Commencement, as the final examinations have not yet been held.

The cabinets of the school have continued to receive additions by purchase and gift, mineralogical, metallurgical and chemical specimens, rocks, fossils and models.

Respectfully submitted,

C. F. CHANDLER,

*Dean of the Faculty.*

Columbia College, April 13, 1888.

## REPORT ON MINERALOGY AND METALLURGY.

*To the President of Columbia College :*

At your request I give below the following report of the operations of the two departments over which I have charge.

The work of the year has been quite complicated on account of the change that was made in the studies by dropping crystallography and blow-piping to the first year and mineralogy to the second and introducing a special course of instruction for the civil engineers. This has necessitated the teaching of two classes at the same time and has been extremely difficult, because the laboratories have frequently had three classes in them working at once. I was always doubtful of the advisability of the change, consented to it only at the earnest request of the engineering department, and the working of it so far leads me to suspect that it may prove not to be a wise one, as the studies appear to be more advanced than the training which the men have previously had in the school justifies. We, however, are working at it in the endeavor to make it all that it should be.

The work of the civil engineers under Mr. Moses' immediate charge has been quite successful and the men appear to be very much interested. It has become apparent from this few months' trial of it, however, that they will have to have separate collections for their study and that practical instruction, quite different from that which has been given heretofore, will have to be initiated for them. All the work that has been done has been much less difficult than it would have been on account of the appointment of a Fellow in the department, but the changes will necessitate a further reorganization in the course of another year.

The obligatory afternoon work has greatly increased the efficiency of the department. All the work of the first term was usually successful on account of the additional instruction which the men have had and the extra time in the laboratory, and the results have been as satisfactory as could have been expected. We hope for better results next year, but without increase in the force, when considerable changes in the methods will have to be made on account of the classes having had less previous instruction. The course in civil engineering we hope to make more interesting and instructive when we get the additional laboratory room in the new building.

In mineralogy a larger number of lectures have been delivered than usual, and the students have shown a very great interest in them. Their practical work has been better done, and they have had the advantage of a different system of instruction, necessitated by having so many students in the same laboratory, which has been found to be such a permanent improvement that we shall perfect the system which has been tried during the year. I look forward to a successful examination, as many of the students are now ready to pass.

In the museum a very large amount of work has been done. Owing to the increase of the appropriations it has been possible for me to fill many gaps in the collection with minerals which I collected during the past summer in the West and also in Europe. I have also been able to ex-



change a much larger number of the duplicate minerals in the course of the year than usual, and have succeeded in obtaining in this way a very large number of species that were lacking, and also have been able to excite a great deal of interest in the collections of the school. Owing to this fact, the value of the collection has been increased more than \$1500. A single exchange from duplicates that have been in the school for a very long time, and which cost the Trustees, nothing, added over \$200 worth to the collection. The stock of duplicates is, however, nearly exhausted.

I have commenced a collection illustrating crystallography with natural minerals. This collection will occupy a considerable amount of space, and will be unlike any collection in this country, and will make the subject of crystallography much more attractive than it has been up to the present time. I have interested a very large number of persons in this collection, but it will take several years to complete it, but it will be in such condition that by the time the students next year wish to study it it will be available for that purpose.

The collection illustrating the physical characteristics of minerals has also been gone over very carefully with a view to increase its utility for study. Nearly the whole of the duplicates have been removed from the old building to the basement. There is, however, very great need in this department of more storeroom, as we have no place to put a considerable number of things that are stored in the old college building, and no place whatever to do the work of cutting and grinding, which is very necessary for the continued usefulness of the cabinet. This, however, I hope will all be remedied in the proposed new building.

A new catalogue for the collection has been made during the year, which greatly facilitates the work in the collection. We have ascertained by a careful examination of all the specimens exactly those that are wanting, and have made a printed list of such species, with a view of obtaining what we do not have that is accessible by means of exchange. The general museum catalogue, which has been for two

years in the hands of the public printer at Washington, and is to be issued as a bulletin of the United States National Museum, has made no progress during the year, the public printer having suddenly stopped without giving us warning, and not having commenced to print again. The collection of minerals has been gone over, specimen by specimen, and more than a thousand labels re-written to make its system entirely uniform and to bring it up to the most recent standard. This work has to be done every four or five years in order to make the collection keep pace with the newest discoveries in the subject.

In the department of Metallurgy the lectures have been regularly given, and several monographs have been written or published in order that the students may have access to information which they could not otherwise get. Arrangements have been made for the systematic collection of metallurgical material from graduates of the school in the West, some of whom have already responded with drawings and collections of modern appliances. A few additions have been made to the collections themselves, but much cannot be done in this direction until a permanent place for them has been assigned. Arrangements have been made by which the students will have conferences and quizzes in this department, so that hereafter they will be taught not only to distinguish but also to examine with the blow-pipe and by means of physical tests all the various metallurgical products.

I had worked out a plan for a metallurgical workshop on a large scale, and had obtained all the estimates for the building and machinery, and had already commenced to solicit subscriptions for the purpose, when I was informed of the plan by which \$500,000 were to be raised, and as this has gone before the Board of Trustees I have held my own plans in abeyance. The plan, if carried out as discussed by the heads of departments who are to occupy the proposed new building, will make the greatest advance that has been made in instruction and technical science since the School of Mines was established, and will be unlike any establish-

ment in this or any other country, and I earnestly hope that it will succeed.

While uneventful, the year has been one of very hard and constant work in the department, and the collections have been very much more useful and valuable than they were at the commencement of the year.

With the proposed new arrangement of instruction it is hoped that the efficiency as well as the grade of the department will be very much raised.

Yours respectfully,

THOS. EGLESTON,

*Professor of Mineralogy and Metallurgy.*

Columbia College, April 10, 1888.

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#### DEPARTMENT OF CHEMISTRY.

*To the President of Columbia College :*

I have the honor to report that in the Chemical Department of the School of Mines during the first term of the past year I met all the First-Year students twice a week and lectured upon the metals. Dr. Vulté, Assistant Instructor in Qualitative Analysis, has held recitations upon the lectures, the class being divided into four sections for this purpose, each section reciting once a week. During the second term I have met the First-Year students, in the course of Analytical and Applied Chemistry, twice a week, lecturing upon Organic Chemistry ; and Dr. Vulté has held recitations upon the lectures. In addition to this the First-Year students in the course of Analytical and Applied Chemistry received instruction in Chemical Physics twice a week, during the second term, from Dr. Wiechmann, Instructor in Chemical Physics and Chemical Philosophy.

I met the Second-Year students in all the courses twice a week, during the entire year, and lectured upon Applied Chemistry. The class was divided into four sections, and each section attended recitations once a week under the direction of Mr. Horne and Mr. Simonds, Fellows in Chem-

istry, and Dr. Wiechmann. The Second-Year students, in the course of Analytical and Applied Chemistry, have also attended four recitations a week throughout the year on the subject of Chemical Philosophy under the instruction of Dr. Wiechmann.

All the students of the Third Class have attended my lectures twice a week on Applied Chemistry, and they have also attended in sections weekly recitations, held by Dr. Laudy, Assistant in General Chemistry, on the subject of the lectures.

I have met the Fourth-Year students, in the course of Analytical and Applied Chemistry, and recitations have been held by Mr. Pellew, Honorary Fellow in Sanitary Engineering and Bacteriology.

In Qualitative Analysis Dr. Wells has given to the First-Year students two lectures a week, and Dr. Vulté has held recitations twice a week upon the subject, the class being divided into two sections.

In Quantitative Analysis Prof. Waller has lectured to portions of the Second, Third, and Fourth classes, and Mr. Bowen has held recitations upon the subject of the lectures; to the students of the Second Year, in the course of Analytical and Applied Chemistry, two lectures and two recitations per week; to the students of the Third Year, in the course of Analytical and Applied Chemistry, two lectures and two recitations per week; and to an elective section of the Fourth-Year students in the course of Mining Engineering an average of two lectures a week, during the last half of the second session.

During the first session Prof. Ricketts lectured twice a week on Assaying to the Third-Year Mining Engineers and Geologists, and Mr. Beebe, the Assistant Instructor, and Mr. Simonds, Honorary Fellow, held the recitations on the same subject. During the second session Prof. Ricketts lectured twice a week to the Third-Year Chemists, and Mr. Simonds, promoted to Assistant Instructor, held the recitations. Prof. Ricketts also gave instruction in the Theory and Practice of Ore-Testing to the Third-Year Mining Engineers and Geologists.

The students in the course of Analytical and Applied Chemistry, in the Fourth Year, have had special instruction from Mr. Colby, Instructor in Organic Chemistry. He has lectured to them five times a week throughout the entire year, and they have also devoted a large part of their time to the practical study of Organic Chemistry in the laboratory.

In addition to the above instruction in the lecture and recitation room, the students have practised the various branches of chemical analysis, etc., as follows:

The First-Year students—Qualitative Analysis, under Dr. Wells and Dr. Vulté.

The Second-, Third-, and Fourth-Year students—Quantitative Analysis, under Prof. Waller and Mr. Bowen.

The Third-Year students—Assaying, under Prof. Ricketts and Messrs. Beebe and Simonds.

The Fourth-Year students—Organic Analysis and Investigation, under Mr. Colby.

I submit herewith the accompanying reports from Prof. Waller, on the work in Quantitative Analysis; from Prof. Ricketts, on the work in Assaying; from Dr. Wells, on the work in Qualitative Analysis; from Mr. Colby, on the instruction in Organic Chemistry; and from Dr. Wiechmann, on the instruction in Chemical Physics and Chemical Philosophy.

The general attendance and progress of the students have been very satisfactory.

During the last summer vacation there was opened for the first time a Summer School in Chemistry. The instruction lasted from the middle of June to the middle of September, and comprised Qualitative Analysis, taught by Dr. Vulté, Assistant Instructor in Qualitative Analysis; and Quantitative Analysis, taught by Mr. Bowen, Assistant Instructor in Quantitative Analysis, and Mr. Martin. This Summer School was established for the benefit of two classes of students:

1st. Regular students in the School of Mines who had failed to complete their Qualitative and Quantitative Analyses during the session. They were required to com-

plete their work, during the vacation, in the Summer School.

2d. Special students, not otherwise connected with the School of Mines, who were permitted to attend the instruction.

The numbers in attendance were as follows:

### SUMMER SCHOOL IN CHEMISTRY, 1887.

#### SCHOOL OF MINES STUDENTS.

	Quant. Lab'y.	Qual. Lab'y.	Total.
Graduates of 1887.....	7	0	7
First-Year Class.....	4	12	16
Second-Year Class.....	5	0	5
Third-Year Class.....	7	2	9
Fourth-Year Class.....	0	0	0
Post-Graduates.....	2	0	2
	—	—	—
Total.....	25	14	39

#### SPECIAL STUDENTS.

	Quant. Lab'y.	Qual. Lab'y.	Total.
Specials.....	3	6*	9

Total number of students:

In Quantitative Laboratory.....	28
In Qualitative Laboratory.....	20
	—
	48
School of Mines students.....	39
Special .....	9
	—
	48

The arrangements for the summer school were not completed till just before the close of the session; there was, therefore, no opportunity to advertise it, but I have reason to believe that, with judicious advertising, a large number of persons would avail themselves of the opportunity to

\* REMARKS.—Two of these also attended Quantitative after completing Qualitative Analysis.

acquire a knowledge of chemistry, especially teachers who are occupied at other times during the year. The work accomplished in the summer school was entirely satisfactory, and it has proved to be a great advantage to give delinquents this opportunity of completing their work, so that when the next session begins on the first of October, they are not embarrassed by the extra work of making up deficiencies of the previous year.

Respectfully submitted,

C. F. CHANDLER,

*Professor of Chemistry.*

Columbia College, April 13, 1888.

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### *SPECIAL REPORT ON QUANTITATIVE ANALYSIS.*

*To Professor C. F. Chandler :*

I have the honor to report the following details regarding the work in my division of Analytical Chemistry (Quantitative Analysis) during the college year.

*Lectures* have been delivered as follows:

To Second-Year students in Chemistry, twice a week throughout the year.

To Third-Year students in Chemistry, twice a week during the first session.

To Fourth-Year students in Mining Engineering, sometimes twice, sometimes once a week, from March 1st, up to the end of the college year. (In preparing the scheme of exercises it was found impossible to assign any particular hour for these lectures; hence I have met the class at such times as were found necessary and convenient to those concerned; usually on Saturday, and sometimes, especially at the start, on some other day of the week as well.)

*Recitations* have been held by my assistant, Mr. H. C. Bowen, as follows:

Second-Year students in Chemistry, twice a week throughout the year.

Third-Year students in Chemistry, twice a week during the first session.

*Examinations* have been held monthly for the Second- and Third-Year students in Chemistry, and also at the end of each term, for each set of students receiving instruction during that term.

*Laboratory Work.* The Second-Year students in Chemistry have been occupied with the examination of twenty-five different substances (representing some sixty or seventy determinations). The list of these substances has already been given. The first six are pure salts, the percentage composition of which is known. The other nineteen are minerals, ores, alloys, furnaces, products, etc.

The Third-Year students in Chemistry have been occupied with the examination of eighteen different substances, affording practice in some of the most important determinations connected with industrial chemistry, proximate analysis, the examination of articles of food, etc.

The Fourth-Year students in Mining-Engineering have been engaged in the study and practice of some of the most important rapid methods of analysis in use in metallurgical works.

Post-Graduate students. In addition to those students pursuing the study of Analytical Chemistry as a part of their regular courses, the laboratory has been used by some post-graduate students for the study of analytical processes with reference to general or special applications. Three of the post-graduate students have been occupied with general analytical work; two, with analysis in its relations to Sanitary Engineering; one, with relation to ceramics, and one with relation to the problems in ore-dressing and milling.

Mr. W. D. Horne, the Honorary Fellow in Quantitative Analysis, was obliged, for business reasons, to leave his position about the end of the first session.

Respectfully submitted,

ELWYN WALLER, Ph.D.,

*Professor of Analytical Chemistry.*

Columbia College, April 6, 1888.



## SPECIAL REPORT ON ASSAYING.

*To Professor C. F. Chandler :*

I have the honor to submit the following report on the instruction given in the Assay Department, and the improvements made in this department during the school year 1887-88.

During the first term I delivered two lectures per week on Assaying, to the Third-Year Mining-Engineers and Geologists. The Assistant Instructor, Mr. Alfred L. Beebe, and the Honorary Fellow in Assaying, Mr. Francis M. Simonds, had charge of the recitations, and assisted in conducting the laboratory instruction.

During the second term I have lectured twice a week, and the recitations have been held by Mr. F. M. Simonds, the Assistant Instructor promoted from the position of Honorary Fellow, in January last, to succeed Alfred L. Beebe, resigned.

In addition to the Instruction in Assaying, I have given lecture room and laboratory instruction in Ore-Testing to the Third-Year Mining-Engineers and Geologists.

The average standing of the students has been very satisfactory, the quality of the work done proving that the change of assaying from the second to the third years was a very wise and desirable step.

No additions have been made to the laboratory facilities during the past year, other than the placing of swinging-doors between the furnace and desk-rooms, which have proved a great comfort and convenience to the students. The new arrangement of the furnaces made last year has resulted in materially improving the temperature of the laboratory, and the furnaces have been found to work very successfully.

Very respectfully yours,

P. de P. RICKETTS,

*Professor of Assaying.*

Columbia College, April 10, 1888.

*SPECIAL REPORT ON QUALITATIVE ANALYSIS.*

*To Professor C. F. Chandler :*

I have the honor to submit the following report of the work done in Qualitative Analysis in the past year. I have lectured to the class twice a week during the year, and the assistant instructor, Dr. Vulté, has held recitations on the subject twice every week.

The laboratory has been open every Monday, Tuesday, Thursday, and Friday, from 2 to 5 P.M., and on Saturdays from 9 A.M. to 2 P.M. The class was divided into two divisions, working in the laboratory on alternate weeks, the division not due in the laboratory being engaged in drawing or blowpiping, except on Saturday, when the whole class attended.

The students, with few exceptions, have worked faithfully, and the work accomplished has been satisfactory.

The attendance at lectures and in the laboratory has been prompt and regular, except in the cases of three of the seniors, who have neglected their work almost entirely.

Respectfully submitted,

J. S. C. WELLS,

*Instructor in Qualitative Analysis.*

Columbia College, April 9, 1888.

*SPECIAL REPORT ON ORGANIC CHEMISTRY.*

*To Professor C. F. Chandler :*

I have the honor to submit the following report of the work done in the Organic Laboratory during the college year 1887-88.

The students who have received my instruction are those of the Fourth Class pursuing the course in Analytical and Applied Chemistry.

*Lectures.*—During the first session the students attended lectures on Organic Chemistry four hours each week. The lectures treated of the methods of analysis and synthesis of organic bodies in general, and the formation and decomposition of compounds of the fatty series. The number of

lectures given in this session was fifty-eight. There were no recitations, but five written examinations were given instead.

During the second session the students attended lectures five hours per week, making a total of sixty-five lectures. Sixty written examinations were also given. The subject discussed was the derivatives of benzene, or compounds of the aromatic series.

*Laboratory Work.*—The course of instruction in the laboratory was substantially as set forth in the Handbook of Information for the year. Each student has had experience in the analysis and synthesis of organic bodies, and has prepared about twenty-four organic substances, and identified them. Practical instruction has also been given in the preparation of artificial coloring matters, and the application of them to wool, cotton, and silk.

The attendance in the laboratory has averaged twenty-three hours per week to each student.

The following statement shows the total time devoted to the subject of Organic Chemistry by the Fourth Class during the year:

	Lectures.	Laboratory
First session....	58 hours.	390 hours.
Second session .....	65 “	300 “

The progress of the class has been satisfactory. Several students, having finished the assigned number of preparations, are engaged upon original investigations, the results of which cannot be foreseen at this date.

Respectfully submitted,

CHARLES E. COLBY,  
*Instructor in Organic Chemistry.*

Columbia College, April 14, 1888.

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### *SPECIAL REPORT ON CHEMICAL PHYSICS AND CHEMICAL PHILOSOPHY.*

*To Professor C. F. Chandler :*

I have the honor of submitting to you the following report for 1887-88.

*First-Year Class :*

*Chemical Physics*.—During the second term I have met the students in the course of Analytical and Applied Chemistry twice a week. The time given was divided between lectures and recitations. The former treated of matter, motion, force, gravitation, work and energy, the three states of matter, specific gravity, weighing and measuring, etc. The recitations held were on the subject-matter of these lectures, and on lessons assigned in Cook's Principles of Chemical Physics, the text-book used.

*Second Year Class :*

*Chemical Philosophy*.—Throughout the year I have met the students in the Course of Analytical and Applied Chemistry four times a week for instruction in this subject. The work was carried out by means of lectures, recitations, and the solving of a great number of stoichiometrical problems. In addition to the prescribed course, time was found for the reading, in class, of an advanced treatise on Chemical Philosophy.

*Applied Chemistry*.—During the second term I have met, once a week each, the students in the Course of Analytical and Applied Chemistry, and the students in the Course of Architecture, for recitations on the subject-matter of the lectures delivered to them by the Professor of Chemistry. In addition to this, the section first named, volunteered and devoted one hour per week to the reading and translation of Wagner's "*Technologie*."

*Senior Class, School of Arts :*

*Chemistry*.—Throughout the year I have met the members of this class (who had elected the study of Chemistry) once a week for recitations on the lectures given them by the Professor of Chemistry. The matter discussed was: in the first term, the Chemistry of the Metals; and in the second term, Organic Chemistry.

Respectfully submitted,

F. G. WIECHMANN, PH.D.,

*Instructor.*

Columbia College, April 10, 1888.

## DEPARTMENT OF MECHANICS.

*To the President of Columbia College :*

I have the honor to report that instruction has been given to *forty-five* students of the third class of the School of Mines in Mechanics. In accordance with previous custom the class has been divided into two sections for the purpose of drill and recitation, one of which has been under my personal instruction whilst the other has attended Prof. Rees. In lectures and in experiments the entire class has attended me.

In former years the applications of the Differential and Integral Calculus were enforced by lecture, but these have now been incorporated in the text-book, and as a result more time has been available for the exhibition of models and for experimental illustration. These changes have been of much benefit to the class and have added much to the efficiency of the instruction given. Recent changes in the curriculum lead to the hope that still greater improvement will be possible in coming years.

Respectfully submitted,

WM. G. PECK,  
*Professor of Mechanics.*

Columbia College, May 9, 1888.

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DEPARTMENT OF MATHEMATICS.

*To the President of Columbia College :*

I have the honor to report that, during the past year, the first and second classes have attended in Mathematics as follows :

The first class, three times in sections, and once as a class—in all four times per week.

The second class—four times per week ; and have completed the prescribed courses of study.

In consequence of the additional requirements in Mathematics for admission, time has been gained to give a more

extended course in Algebra to the first class—an addition which has long been desired, but for which, till now, there was no opportunity. The supplementary course consists of Graphical Algebra, which not only illustrates and enforces the general theory of equations, but also affords an excellent introduction to the higher branches of analysis.

The Honorary Fellow in Mathematics, Mr. Stuart, appointed by you at my request, has been of service in preparing, and marking for criticism the solution of, practical problems in engineering, applications of the mathematics of the second year, given as voluntary exercises to members of the second class.

Respectfully submitted,

J. H. VAN AMRINGE,

*Professor of Mathematics.*

Columbia College, May 2, 1888.

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### DEPARTMENT OF PHYSICS.

*To the President of Columbia College:*

The following is a statement of the work done in the Department of Physics in the School of Mines during the year:

*Third-Year class* was occupied two hours per week during the first and second terms on the same subjects as the elective Seniors.

*First-Year class*, was occupied three hours during the first and three hours during the second term as follows: Expansion of solids, liquids, and gases; mercurial and air thermometers; maximum and minimum thermometers; density of gases; vapors and their tension; evaporation; ice-machines; hygrometry; conduction of heat by solids, liquids, and gases; radiant heat; latent heat of liquids and gases; high- and low-pressure steam-engines; magnetism; magnetic induction; terrestrial magnetism; magnetic attraction and repulsions; frictional electricity induction; electrical attractions and repulsions; Holtz's machine; electro-

scope; electrophorus: spark, nature and duration of; Leyden jar; Franklin's plate; discharger; electrometers: mechanical, chemical, calorific, and magnetic effects of the discharge.

Galvani's observations; Volta's experiments; constant batteries; Oersted's experiment; properties of the electric light; electrometallurgy and decomposition of salts; magnetism by currents; telegraph; induction by magnets; Gramme-machine; Ruhmkorff's coil; induction; diamagnetism; thermo-electricity.

Optics, velocity and intensity; photometers; reflection; mirrors, plane, concave, and convex; refraction by plates and prisms; spectra; spectroscope; chemical lines; fluorescence; achromatism; simple and compound microscopes; telescopes; camera obscura; solar microscope; photography; eye and vision.

Acoustics; propagation and velocity of sound in solids, liquids, and gases; reflection and refraction of sound; measurement of the number of vibrations; chronograph; tuning-fork; synthesis of sounds; interference; vibrations of strings; organ pipes; flute pipes; reed pipes; vibrations of rods; plates, and bells; Lissajous' experiments; phonautograph; phonograph; telephone; etc.

Many problems relating to the above were solved by the different classes.

Respectfully submitted,

O. N. ROOD,

*Professor of Physics.*

Columbia College, May 1, 1888.

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## DEPARTMENT OF ENGINEERING.

*To the President of Columbia College:*

I respectfully present the following report of the operations of the Engineer Department of the School of Mines for the last year, to wit:

In the first place I desire to commend the adjunct Pro-

fessors, Instructors, and Assistants for their unremitting and conscientious attendance to their various duties. There has been no falling off of interest, I feel sure, on the part of any one, but rather an increased enthusiasm.

A larger number than usual of the students have taken the Course of Civil Engineering, owing to the fact that civil engineering enterprises throughout the country have been unusually active for several years, and more opportunities are offered just now, in this profession, for graduates, than in other branches of engineering.

The Drawing Department, under Mr. Mayer and Mr. Woolson, has shown increased efficiency, and is in excellent condition ; more good work having been done by students than in any previous year.

The Surveying Department, under Prof. Munroe, especially the summer school, in which most of the surveying is taught theoretically and practically, is, I believe, without a rival in the completeness and thoroughness of the instruction.

The Summer School of Mechanical Engineering, under Prof. Hutton, is still kept up with great advantage and profit to those who attend it. An application has been made to the Trustees for an appropriation of \$500 for this summer school in order that Mr. Hutton may employ an assistant, and in other respects make this summer school more effective.

I trust this appropriation may be granted, as Mr. Hutton has conducted this summer school for nearly ten years at expense to himself and entirely without aid.

The re-arrangement of hours in the different years, equalizing the hours of instruction in the different classes, has worked advantageously in the Engineering Department.

I would add only a few words further in regard to the general course of instruction in the Engineer Department, relating to a graduate course of instruction.

It seems to me very desirable that a graduate course for engineers should be established in order that those who desire to pursue special branches of professional work may



have special opportunities for doing so. Many of our graduates would gladly spend a year or two more in special studies if they had the opportunity of doing so. But to make a graduate course efficient, appliances for instruction are needed which we do not now possess, and I only mention the subject for the purpose and object of keeping it in the foreground as one of the desirable things to be accomplished whenever it may be found practicable.

Respectfully submitted,

W. P. TROWBRIDGE,

*Professor of Engineering.*

Columbia College, April 5, 1888.

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DEPARTMENT OF ARCHITECTURE.

*To the President of Columbia College :*

At the close of the report which I had the honor of presenting a year ago, I said that I should at the present time be able to give the result of certain experiments, which the crowded state of the Course in Architecture had made it necessary to set on foot, with the view of abridging the time hitherto engrossed by the mathematics of the second year. This it has been attempted to effect by giving prominence to the geometrical rather than to the algebraical applications of the Differential Calculus, introducing this subject as early as possible into the study of Analytics, and largely illustrating and enforcing the relations established by means of graphical exercises. The ground gone over has been restricted to that absolutely necessary to an understanding of the text-books in Engineering and Mechanics, in the hope that in this way a good working knowledge of the business can be gained in a limited amount of time.

It is still too soon to say how successful this experiment will prove. This can be seen only when these young men come to apply their knowledge. But it is very much to be desired that it shall be made to succeed, in one way or

another. These studies occupy a very different place in an architect's equipment from what they do in an engineer's. The work of the engineer is mainly based upon mathematics, and his daily tasks illustrate and are illustrated by the principles laid down in the text-books. A purely theoretical acquaintance with them thus presently becomes practical knowledge. An architect, on the other hand, is mainly occupied with other things, and it is only occasionally, and generally long after his school days are over, that he has need to use his mathematics, and then only in its simplest applications. The training he needs at school, then, is much less extensive than that proper for the engineer, but so far as it goes it needs to be as practical as possible, and the main principles and methods need to be made so familiar, and to be so thoroughly assimilated, that they can never be forgotten. An architect does not need to study such long and hard lessons as the engineer, but it is more necessary that he should learn them well while at school, for it is in general his only chance of learning them at all.

But while the sufficiency of the methods now in hand remains to be proved, the signal advantage to the course of cutting down the time hitherto devoted to these subjects is already apparent. A large part of the time out of school formerly devoted to the study of the mathematics can now be given to strictly architectural studies, especially to free-hand drawing, from the flat or from the cast, exercises for which there is little time during the day, and which can be pursued to great advantage in the evening. It is also possible now to insist that a chief part of the study needed in other branches of draughtmanship shall be done at home, thus greatly increasing the amount of work done in the drawing-rooms. It is a maxim of prime importance, both in a practical and in an educational point of view, that every drawing shall be made twice, first as a sketch, upon which all the intellectual labor shall be spent, and then as a proper drawing, in the execution of which neat, rapid, and accurate workmanship shall engross the attention. To

learn thus to divide the labor is the first and most important step in learning how to work, whether in Descriptive Geometry, in Perspective, in Shades and Shadows, in the study of the Orders and other architectural forms, or in the practice of Design. The apparatus of drawing-board and T-square is needed only for the execution of the diagrams, and all this preparatory sketching, that is to say all the thinking and studying, can be done at home as well as at the school. To rescue two evenings a week from mathematics is, accordingly, to double the amount of other work and greatly to improve its quality.

The time gained during school hours by giving only two hours a week to recitations in these subjects, instead of four, has also enabled us to try the experiment of giving two hours a week to reading a French text-book with the class. This I was glad to do, for I had found that a chief part of our students were too unfamiliar with the French language to make any use of the French books in our library. The plan, however, was not without practical difficulties, for it was plain that if I gave out long lessons they would not be learned, and the study would be too superficial to be of real benefit, while if the lessons were short we should never get through the book, and, besides, the exercises would be intolerably dull and uninteresting. The only escape from this dilemma seemed to lie in giving each student a different page to learn, a device that has worked so well that one cannot but feel surprised that it is not more generally adopted. In this way the class have read the whole of Maspero's *Archéologie Egyptienne*, at the rate of twelve or fifteen pages a week, with interest and enjoyment, and have made marked progress in command of the language. At first only half a dozen out of twenty-four or five made even a passable performance. Now hardly any fail to give both the French and the translation with fair precision, and almost all succeed very well in translating from French into English and even from English into French without looking at the book.

The methods of studying the history of style pursued by

the students of the third and fourth years, both in architecture proper and in ornament, which were described in my last year's report, have this year been applied to the period of the Renaissance with similar success, though these methods demand for their best results greater resources of draughtmanship than most of our students can command. This consideration makes it the more imperative to devote a chief part of the time in the second year to graphical exercises.

I have this year, for the first time, had the architectural students of the first year under my charge from the beginning, all their drawing having been done in the rooms of the department. This has been made practical by the addition to our space of two adjoining rooms, formerly occupied as a conference room by Dr. Newberry. We have thus been able to accommodate nearly sixty students more comfortably than half that number a year ago.

Respectfully submitted,

WILLIAM R. WARE,

*Professor of Architecture.*

Columbia College, April 10, 1888.

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## REPORT OF INSTRUCTION IN BIOLOGY AND HYGIENE.

*To the President of Columbia College :*

At the beginning of the last school year it was decided that in future instruction in Biology and Hygiene should be given to the students of the Second instead of the Third class ; that attendance on these lectures should be compulsory instead of voluntary, as had previously been the case, and that a quiz upon the lectures should be established. In accordance with this plan I have delivered two courses of lectures to the students of the Second class. The first course, delivered in October and November, 1887, was devoted to the general principles of Biology, with special reference to human physiology, to causes of disease and

bacteriology, and to modes of first help in accidents and injuries in the absence of a physician.

The second course of lectures, delivered in March and April, 1888, was devoted to food and its adulterations, air and ventilation, water supply, sewage disposal, and other matters connected with municipal sanitary engineering. The attendance on these lectures had been good, and the students have been interested.

For the results, as shown in the quizzes and examinations, I would refer to the report of Mr. Stuart, herewith transmitted.

The laboratory courses of instruction in Microscopy and Biology for the Chemists of the Second and Third classes have been continued through the year, as is shown by the report of Dr. Julien, and with satisfactory results.

Some useful and instructive apparatus and models have been added to the teaching resources of this department during the year, but it still requires additions of the same kind to provide proper facilities, and estimates for these have been forwarded.

Respectfully submitted,

JOHN S. BILLINGS,  
*Lecturer on Biology and Hygiene.*

Columbia College, April 6, 1888.

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## REPORT ON INSTRUCTION IN MICROSCOPY AND BIOLOGY.

*To the President of Columbia College:*

I have the honor to report that the two classes under my charge, consisting of the students in the Second and Third Year of the Chemical Course, are making good and orderly progress, better, I think, than in any preceding year, partly in consequence of the better facilities and greatly needed apparatus which have been added to our laboratory. The time of our sessions being very short, and the work consist-

ing mainly of laboratory practice, proper apparatus and careful management are necessary to carry out the schemes of study. As it appears that fewer students than usual have entered the chemical course, the classes have been this year smaller, but of course the same labor and attention were required, and have naturally effected more in consequence of the smaller numbers.

The Chemical students of the Second Year will have been taught, during four hours of session each week, the theory and use of the microscope, a variety of methods of mounting preparations, and the application of this form of study to the examination of textile fibres and fabrics, paper, handwriting, adulteration of foods, micro-chemical examination of crystals and precipitates, micro-toxicology, micro-spectroscopic examinations, and identification of substances by refractive index. The preparations, drawings, and examination reports they have made this year are unusually fine.

The Chemical Students of the Third Year have been occupied the same amount of time, four hours each week. Having already been through the year's course just stated, and acquired a fair knowledge of manipulation of the microscope, they began this year by learning to make photomicrographic pictures from objects they had prepared for the microscope, then proceeded to a study of certain unicellular and simple plants, yeasts, moulds, algæ, infusoria, etc., and have spent the rest of the sessions this winter mainly in bacteriological investigation, with special application to the study of the sanitary character of drinking water, and of air, and the discrimination of the value of germicides.

Considerable additions have been made to our Museum specimens of microscopical and biological material, mostly without any expense, except for expressage. Our considerable collection of living objects has also been this year increased, to provide abundant living material for our work, in the form of varieties of living yeasts, moulds, fungi, fresh-water algæ, infusoria, and cultures of bacteria and microbes,

characteristic of pure and of impure drinking waters and air from various sources.

I remain, very respectfully,

ALEXIS A. JULIEN,

*Instructor in Microscopy and Biology.*

Columbia College, May 7, 1888.

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### *SPECIAL REPORT ON HYGIENE.*

*To Dr. John S. Billings :*

In accordance with your request I respectfully submit the following report on progress in Hygiene during the present year of the second class of the School of Mines.

During the fall course of lectures a series of recitations on the lectures was held, and a record of standing in recitations and attendance at both lectures and recitations was kept.

The average standing for the first term was good. A semi-annual examination was held in February at the appointed time, and was satisfactorily passed by those students who were entitled to take, and did take, the examination. By action of the Faculty of the School of Mines, a few students were debarred from taking the semi-annual examination on account of excessive non-attendance on lectures. During the present course of lectures the recitations have been resumed, and a fair average standing is maintained.

Throughout the winter a very satisfactory interest in the lectures on hygiene has been shown by the students.

Very respectfully submitted,

W. H. STUART,

*Fellow in Engineering.*

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### *REPORT ON GEODESY AND PRACTICAL ASTRONOMY.*

*To the President of Columbia College :*

I have the honor to report as follows on the work of this department :

(1) *The Fourth Class* in Geodesy (sixteen students) has met me twice a week for lectures and recitations on the following subjects: time, mathematical theory of the transit instrument; mathematical theory of latitude determinations by sextant and by zenith telescope; mathematical theory of longitude determinations; method of calculating apparent places of stars from their mean places; pendulum observations for determining the figure of the earth; magnetic observations for determining the declination of the needle, etc.; theory and use of method of least squares.

(2) *The Third Class* in Astronomy and Geodesy (twenty-five in number) has attended two hours a week. In the first term, as usual, the subject of general astronomy was dealt with. During the second term Geodesy was begun.

(3) The work of the Summer Class in Practical Geodesy has been made the subject of a special report, as in former years.

Respectfully submitted,

J. K. REES,

*Professor of Geodesy and Practical Astronomy.*



*SCHOOL OF POLITICAL SCIENCE.*

**APPENDIX C.**

**SCHOOL OF POLITICAL SCIENCE.**

**REPORT BY THE SENIOR PROFESSOR.**

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*To the President of Columbia College :*

The courses indicated in the Circular of Information of the School have been given in the School of Political Science during the present year and by the persons designated there. The attendance has been good and uniform and the work accomplished reasonably satisfactory.

The Faculty of this School have been greatly gratified by the addition of Dr. E. R. A. Seligman and Mr. F. W. Whitridge to their regular force. This increase of strength will enable them to develop the curriculum of the School in several necessary directions and to support more easily the burden of their publications. The Academy of Political Science has been more than usually active during the present year, and has contributed many valuable monographs to the development of Political Science, for future publication.

*The Political Science Quarterly*, edited by the Faculty of this School, is gaining largely in circulation and, I think, in favor with its readers.

Respectfully submitted,  
JOHN W. BURGESS.

Columbia College, May 7, 1888.

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**DEPARTMENT OF POLITICAL ECONOMY AND  
SOCIAL SCIENCE.**

*To the President of Columbia College :*

In the Department of Political Economy and Social Science I have the honor to report that the following work

has been done: In the School of Political Science, the First-Year class has followed the same course as the Seniors, mentioned in report on School of Arts.

The Second and Third-Year men have had a course of lectures on the theoretical and practical statistics, two hours per week through the year.

Dr. Seligman has given a course of lectures to the Second and Third-Year men, two hours per week through the greater part of the year, on "Railroad Problems."

Respectfully submitted,

RICHMOND M. SMITH,

*Professor of Political Economy and Social Science.*

Columbia College, April 19, 1888.

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## *REPORT ON INSTRUCTION IN EUROPEAN LAW.*

### *To the President of Columbia College :*

I have the honor to submit the following report upon the work of the year :

In the School of Arts I gave instruction in English History to the Junior class twice a week during the first session.

In the School of Political Science I lectured upon the History of Roman Law three hours a week during the first session; and upon the History of Mediæval and Modern Law three hours a week during the second session. These lectures were delivered to the students of the Second year.

In consequence of a change in the arrangement of the curriculum, my course of lectures upon Comparative Jurisprudence was omitted this year. The course has been transferred from the second to the third year, and the Third-Year students had already heard these lectures in the preceding academic year, 1886-7.

I lectured, as usual, upon International Private Law, one hour a week through the year.

Respectfully submitted,

MUNROE SMITH,

*Adjunct Professor of History and*

*Lecturer upon Roman Law.*

Columbia College, April 10, 1888.

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REPORT ON INSTRUCTION IN ADMINISTRATIVE  
LAW.

*To the President of Columbia College :*

In answer to your request for a report on the work done in the past year in the Department of Administrative Law in the School of Political Science, I beg to submit the following :

In accordance with a resolution of the Faculty, I have this year divided my former course of lectures on Administrative Law into two courses, one of three hours a week on General Administrative Law, which is now one of the studies necessary for the degree of A.M.; the other of two hours a week on Local and Municipal Government, which is one of the studies necessary for the degree of Ph.D.

Lectures in these courses have been regularly given during the past year, and, in my opinion, the favorable results anticipated by the Faculty from the change from last year's plan which I have indicated, have been obtained.

Respectfully submitted,

FRANK GOODNOW,

*Adjunct Professor of Administrative Law.*

Columbia College, April 26, 1888.

*SCHOOL OF LAW.*

**APPENDIX D.**  
**SCHOOL OF LAW.**

**REPORT FROM THE WARDEN.**

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*To the President of Columbia College :*

The Warden of the Law School would respectfully report as follows :

The attendance of the students and their devotion to the studies assigned to them by the statutes have been highly satisfactory. The Senior class has pursued the rules of Equity Jurisprudence under Professor Lee, and the topics of Evidence, Torts, and the Code of Procedure under Professor Chase. In the topics of Shipping and Insurance they have been instructed by Professor Dwight. They have also had under him a review of the Law of Contracts. They have been reviewed by Professor Lee in the Law of Real Estate. Professor Ordronaux has delivered his regular course of lectures in Medical Jurisprudence, and Professor Chase a course of voluntary lectures in Criminal Law.

The Junior class has studied under Professor Dwight the general outlines of Municipal Law, and more particularly the Law of Contracts, and under Professor Lee the Law of Real Estate.

Each class has been divided into two sections, so that the professor in charge has been obliged to conduct two exercises each day on the same subject.

The Moot Courts have been conducted with much spirit on the part of the students. These exercises are in a high degree beneficial, and contribute greatly to bridging over the distance between the work of the class-room and the business of professional life.

The number of students in the Senior class has been two hundred and seven; in the Junior class two hundred and seventy-four. The graduating class of 1887 numbered one hundred and twenty-four. Fifty-six literary colleges are represented among the students of this school.

The first, second, and third prize tutorships, filled by the appointment of Mr. Robert D. Petty, Mr. Paul D. Cravath, and Mr. Alfred G. Reeves, have proved highly useful, and have more than justified the expectations I entertained of its success in recommending the adoption of the tutorial system. They have been attended by the students in regularly increasing numbers. Mr. Petty, the Senior prize tutor, has instructed the students in the rules of Common Law and Equity Pleading. Mr. Petty has also acted as instructor in the preparation of legal briefs and the use of legal decisions.

Respectfully submitted,

THEODORE W. DWIGHT,

*Warden of the Law School.*

Columbia College, May 1, 1888.

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DEPARTMENT OF HISTORY, PUBLIC LAW, AND  
POLITICAL SCIENCE.

*To the President of Columbia College :*

In the department of History, Public Law, and Political Science in the School of Law, the Junior class have received three lectures per week, throughout the year, on the subject of Comparative Constitutional Law, and the Senior class two lectures per week, throughout the year, upon the History of Diplomacy and International Law.

Respectfully submitted,

JOHN W. BURGESS.

**APPENDIX E.**  
**SCHOOL OF MEDICINE.**

REPORT BY THE SECRETARY OF THE FACULTY.

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*To the President of Columbia College :*

In behalf of the School of Medicine, I have the honor to report that the session of 1887-8, now closed, took place in the three new buildings given by the late William H. Vanderbilt and his children, and by William D. Sloane, Esq.

These three buildings—the College building proper, the Sloane Maternity Hospital, and the Vanderbilt Clinic, have fully realized the high expectations formed of their usefulness, and have turned out to be admirable seats of educational work, both as regards the fundamental matters of light, heating, and ventilation, solidity and spaciousness, and as regards the details of their plant.

It is confidently hoped by the Faculty that the new accommodations of the College will render possible the progressive striking out of numerous new lines of educational activity.

For the session of 1888-89, and thereafter, an entrance examination in English, Latin, Arithmetic, Algebra, and Geometry, is to be exacted of all candidates for first matriculation who shall not bring evidence of study at such institutions as confer a superior grade of preliminary or professional education.

The number of matriculates for the calendar year 1887 was eight hundred and nine (809), an increase of two hundred and three (203) over 1886, and of three hundred and seven (307) over 1885.

Of these eight hundred and nine,  $27\frac{2}{10}$  per cent. were on matriculation possessed of degrees, viz.:

In medicine.....	57
In arts, philosophy, science, etc.....	169
Total.....	226

In September, 1887, there were examined for the degree of M.D., eighteen candidates. Of these, nine failed to pass, equal to 50 per cent.

In April and May, 1888, there were examined for the degree of M.D., 139 candidates. Of these, 33 failed to pass, equal to  $23\frac{7}{10}$  per cent.

Respectfully submitted,

JOHN G. CURTIS, M.D.,

*Secretary of the Faculty.*

## APPENDIX F.

### REPORT ON THE SCHOOL OF LIBRARY ECONOMY.

BY THE DIRECTOR.

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*To the President of Columbia College :*

The second year of the School has been in all respects even more successful than the first. Most of my report of last year applies equally to this, and to avoid repetition reference is made to it, and to the annual circular of the School, which contains much supplementary information.

**Applications.**—Nearly 100 informal applications were made before the year opened, in spite of the constantly repeated and widely circulated notices that only ten places were vacant. Through the American Library Association, *Library Journal*, *Library Notes*, and our own publications and correspondence, as well as by the advice given at the library, and by all former students, we have made widely known the policy of the School to limit its numbers by advancing its standards. Trial proved the need of much more definite information than is required by other schools in selecting candidates. A blank of thirty-two searching questions is sent each applicant with a printed letter making plain that the School will admit only a small part of those who would be glad to come, and that it holds out no inducements of positions or salaries to those who complete the course. As a result, about half of those who send a first application do not attempt to meet our requirements, and are not counted as candidates for admission. In spite of this vigorous weeding-out process over forty tried for the



ten vacancies last October. The ten most promising candidates were selected and notified of their admission, but before the term opened, one after another successfully urged special reasons for admission, till the total number in the junior class was swelled to twenty-two.

**Attendance.**—There have been in attendance eleven seniors and twenty-two juniors, coming from eleven different states, Massachusetts leading with eleven. In the senior class, taking the second year's work, there are two men and nine women coming from seven different states. The junior class enrolls six men and sixteen women coming from nine different states, with one man from Germany. Of the eleven seniors, eight have been engaged in library work before coming to the School, while of the juniors only four had been librarians. As last year, the attendance has been remarkable for its regularity, and for the enthusiasm and industry with which the work has been prosecuted throughout the year. Two gratifying changes are noticeable. Nearly all the students this year wish to take the complete two years' course instead of the three months' lecture term, and of those who took the shorter course last year and then accepted positions in libraries where their services were and are still in demand, some have resigned and will spend another year at the School, thus giving the highest testimony to the practical good to be got from the course.

**Extent of course.**—In developing from our modest beginnings two years ago, we offered last year seven months instead of three. So far from diminishing the applications and attendance, both have materially increased, and those who have spent seven months this year are even more eager to take the senior year than those who had only the short course of last year. The demand is unmistakable, and with the next term the School expands to the full college year, beginning October 1st, with the other schools of the university. As we have sessions Saturday, and work clear up to commencement, our year is really longer than that of any other department.

Repeated calls for a summer session have been made. The need is recognized, but till the School receives financial support from endowments or appropriations, it is only at great personal sacrifice that the staff can carry it on during even eight months of the year.

The plan announced made the senior year only a review, with work in the library. It was, however, found wise, in the past year, to introduce special senior work, the success of which has led to the organization of a senior course in addition to the laboratory work, supervision and review. Double the number that can well be received have already applied for entrance on this advanced work.

**Hours and vacations.**—The class room has been open for work and some of the class have usually been present from 8 A.M. to 10 P.M., daily. The lectures have been regularly at 11:30 A.M., 2 and 3:30 P.M., with occasional additional lectures, quizzes, or instructions earlier and later. The average during the lecture term was about four hours a day in class. The rest of the time has been given to preparation, revising notes, and practice under the teachers. Hereafter it is hoped that the extension of the school year will make it unnecessary to have more than three hours daily in class.

The usual college holidays have been observed by omitting lectures, though most of the class have chosen to work in the library. The two weeks' recess was not taken at the holidays as in the other schools, but class work was carried on except on Christmas and New Year's. Next year lectures will be discontinued as in the rest of the college, but facilities for work will be offered so that each student may elect to rest or work during the two weeks.

**Instruction.**—Besides my own work, Messrs W. S. Biscoe, and G. H. Baker and Misses Cutler, Jackson, and Plummer of the staff have given much of their time to the School. Others have rendered assistance when their own departments were being studied. In addition we fortunately secured as teacher of dictionary cataloguing Miss Harriet E. Green of the Boston *Athenæum*, for many years the head cataloguer under Mr. J. L. Whitney at the Boston Public

Library. The success of her work was marked and modified only by insufficient time. With the next class Miss Green has the entire month of November, while October will be used by Miss Cutler and her assistants in preliminary training for the dictionary instruction.

There has been a noticeable improvement in both instruction and lectures during this second year, as was to be expected from the experience of the experimental session. Every thing points to a still further advance in the good work already done. A teacher who has been in daily contact with the class and is familiar with all its previous work and needs can help them more than a comparative stranger of greater ability and knowledge on that special topic. This fact requires a larger portion of the work to be done by resident teachers, who must be paid for services. On the other hand the value of personal meeting and conversation with recognized authorities has not been overestimated.

**Lectures.**—Beside the instruction, the junior class has attended 260 lectures or substitutes on the lecture hours such as quizzes or seminars. Of these I gave 101, Mr. W. S. Biscoe 52, Mr. G. H. Baker 16, Prof. C. Sprague Smith 15. Prof. Smith has generously given this bird's-eye view of foreign literature such as every librarian ought to have. His familiarity with all the prominent authors of the leading European literatures made his lectures, extracts, and original translations highly enjoyable as well as profitable. To him more than to any one else outside the library staff is the School indebted.

To twenty-two of the leading librarians of the country and to seven other specialists we are again greatly indebted for valuable coöperation. Fifteen gave a single lecture each, five gave two each, four gave three each, while five gave courses of four to eight lectures each, making a total of sixty-seven lectures in this group. The names of the lecturers are printed in the annual register of the School.

To these must be added twenty-seven bibliographical lectures given by our own professors who have coöperated with the School to a gratifying extent.

Beside the inherent merits of the lectures the class gained much from the opportunity of meeting personally the leading men and women of the profession. Experience shows that in some cases this latter is the chief gain, for direct instruction can hardly be given to advantage by one not intimately acquainted with what has gone before and is to come after.

**Inspections.**—The class visits to 19 different libraries for critical studies of their methods have again proved of the utmost practical value and emphasizes the value of our metropolitan location, for nowhere else could so extensive opportunities be found within a practicable distance from the School. Each visit has been followed, as last year, by a quiz which has brought out and discussed the points best worth remembering.

**Courtesies.**—As noted last year the School has peculiar reason to be grateful for many favors shown it. On every hand is evinced a disposition to aid in its work. Libraries, book-houses, binderies, etc., have vied with each other in making our visits pleasant and profitable. Professors in our college and specialists outside have responded cordially to our requests for unpaid assistance. In many cases complimentary tickets and invitations to enjoyable lectures from such sources, exhibitions, and entertainments have been sent.

The class have attended four meetings of the N. Y. Library Club, which meets in the class rooms, and cordially invites all our students to share in its privileges. This has given valuable opportunity for acquaintance with more leading libraries of New York and vicinity.

**Rooms.**—The old library-hall which had served as a makeshift for quarters last year was materially improved by taking out partitions and opening two new windows for light; by replacing the oil lamps with electric fixtures; and by putting in a cloak room, postal boxes, bulletin boards, and other conveniences. Space for the unexpectedly large class was made by providing each senior student with a small table with drawers. While better accommodations would

be very acceptable, we can do an admirable work in the present quarters, and shall make no plea for better while suffering so seriously for more help in the teaching.

**Public appreciation.**—The year has been marked by a constant growth in appreciation of the practical value of the School. Scores of papers and magazines have given it warmest commendation, but more important is the recognition it has already won from the library world. At the last meeting of the American Library Association no feature was more prominent than this appreciation of the School. By request of the Program Committee one of the Senior class read a paper on "The Library School from a Student's Standpoint." The committee appointed four years before to consider this subject made three reports from the three of its members who had personally spent a week or two in visiting and studying the workings of the School. These reports vied with each other in praise of the undertaking. The full reports were given in the official proceedings, pp. 116-118; in the *Library Journal*, vol. xii., and in *Library Notes*, vol. ii., pp. 228-241. I append a brief extract from each to show their spirit.

Mr. S: S. Green, Worcester (Mass.), Public Librarian, reported:

"The director of the School, the teachers and pupils, all of them engaged in the work of the School with manifest enthusiasm.

"Energy and wisdom were apparent in administration. The instruction given was thorough, liberal, and profuse. The devotion of the scholars was remarkable, and their intelligence, capacity, and preliminary general education very noticeable."

Mr. W. E. Foster, Providence Public Librarian, noted:

"The fact that the School had in its very first year so closely approximated to the conception presented as desirable in advance, and was also greatly impressed, on visiting the School during the winter, with what might be called its 'spirit.' This was not merely one of enthusiasm, but of complete devotion to the work, as shown in many ways;

notably in the refusal by some of the pupils of offers of library positions in order to complete their course at the School, in the petition by the pupils to have the length of the term extended, and in their evident preference of the School and its discipline over the attractions of various entertainments in the city. The whole aspect is very promising for the future."

Miss H. P. James, Librarian Osterhout Free Library, Wilkes-Barré (Pa.), reported:

"I am glad of an opportunity to make a report upon the School of Library Economy, because of my special advantages in observing its methods during a two weeks' visit to it, and also because I am having a daily proof of the excellence and thoroughness of its practical outcome in the work of two of its pupils.

"What especially impressed me at the School, apart from the enthusiasm of the students, which was almost phenomenal, was the *breadth* of the teaching which was aimed at. Not only was library work of every description, from the minutest detail to the broadest generalization, carefully considered, but the utmost pains were taken that no *one* system should be taught exclusively. The Dewey System was taught as a matter of course, but all other systems had a fair and candid hearing, and the students were constantly obliged to do their own thinking, and arrive at their own conclusions after a fair exposition and discussion of other methods had been presented by different visiting librarians.

"No more delightful task ever fell to me than to speak upon library work to a class of such eager, interested listeners, and I know I only voice the experience of others in saying so. The many questions asked concerning the methods I had touched upon were so direct and practical as to show the excellence of the training and the earnestness of the students. I felt that a grand and needed work was well begun, and that the aim of the School was in the right direction. I am not competent to go into any detail upon the methods of the School. Doubtless many improvements will be made this year, and in future years; but I know I

am right in saying that the School will continue to be of the utmost *practical* value, and its establishment marks the beginning of new life and zeal in library administration."

The following resolution reported by Judge Chamberlain, Boston Public Library, Chairman Committee on Resolutions, was passed unanimously by the Association:

*Resolved*, That this Association has observed with pleasure and gratification the first year's workings of the School of Library Economy at Columbia College, and that it regards the work there initiated as of great promise for the future.

Quite as significant have been numerous references in reports, articles, and correspondence of leading library officials, to the School as the proper source from which the best libraries must hereafter draw their best librarians, cataloguers, and assistants. The rapidity with which the School has won such general recognition is most remarkable and gratifying. Though the first class graduates only this week, the sincerity of the numerous professions referred to above has been proven by the number of calls for the results of our teaching.

Among the libraries that have employed one or more from our School are: Newberry (Chicago), 2; St. Louis Public; Osterhout (Wilkes-Barré), 23; Y. W. C. A. (New York), 4; New York Free Circulating, 3; Pratt Institute (Brooklyn), 2; Union for Christian Work (Brooklyn), 4; Saugus (Mass.) Public; Bowdoin College (Me.); State College (Orono, Me.); Lafayette (Ind.) Public; W. C. T. U., Trenton (N. J.); Hartford (Conn.) Wellesley College, 2; Indianapolis (Ind.) Public; Railroad Mens' (Vanderbilt building, New York); Alfred University (Alfred, N. Y.) 2; University Club (New York); North Adams (Mass.); Columbia College, 11. The figure after the library shows where more than one from the class has been employed. Three seniors and one junior went back to positions previously held, so that the number of new positions is really four less than above given. Members of the junior class fill six of the positions noted above.

Some of the above were brief engagements, for catalogu-

ing, revising, and other special assistance. In some cases a student took one place and later resigned it for a higher salary elsewhere. This happens constantly with those who accept places on our own staff, at the insufficient salaries paid. As a result we record 32 engagements filled by 19 students of the class of '88, and 6 from the class of '89. The list shows that the services of our students are wanted. The salaries, while better than given similar candidates without the training of the School, are very small, and will not attract to the work any who chiefly seek remuneration. Only two in the list began at over \$1,200 a year, and most of them at not over \$800. Some have thought best to accept much less for the first year while gaining needed experience and building a reputation. As the demand for our graduates exceeds the supply, salaries will inevitably improve till they come in time to equal what the same ability and special preparation command in teaching or other intellectual pursuits.

**Needs.**—It is essential to the best results that much personal supervision and revision of work should be given to each pupil, and that quite a portion of the work done by volunteers from other libraries should hereafter be done by paid instructors. This requires double the force of teachers. At present the heavy work of the School is added to very heavy work in the library, with the result that neither can be done properly. The marked success of the School, its extension from a three months' to a two years' course, and its increase in numbers from the eight or ten expected to four times the number, seem to justify as a modest request an appropriation of \$5,000 per year for salaries of instructors, and for some compensation to the lecturers who have thus far given their services. Such support would enable the library staff to carry on the college library properly, and each year carry it nearer the high ideal at which we aim, but which we can never attain while so heavily handicapped by double duties.

That the need of such a school was more urgent than any of us realized is sufficiently proven by the marked success



of these two years. If, without experience here or elsewhere to guide us, with insufficient teaching force, without any appropriation, with lectures unwritten, and the course only partly defined, we have been able to accomplish so much, we are certainly justified in hoping much from the coming years when most, if not all, these initial difficulties have been removed. We have reason to be proud of what has been done under adverse circumstances, but there is every promise that the future sessions of the School will be attended with a still higher measure of success.

Respectfully submitted,

MELVIL DEWEY,

*Professor of Library Economy.*

Columbia College Library, June 12, 1888.

## THE LIBRARY.

### APPENDIX C.

#### REPORT ON THE LIBRARY.

BY THE CHIEF LIBRARIAN.

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*To the President of Columbia College :*

I beg to submit herewith my fifth annual report, covering such points as are not sufficiently treated in the annual Circular of Information, and the annual statistical tables and notes which record work in detail, and are printed at the close of each financial year.

**Building.**—The new shelving provided one year ago was filled as soon as finished, in relieving overcrowding. During the year the additions have exceeded the space available so that the pressure for shelving is felt more than ever before. Economy and convenience of administration and the protection of the books against needless injury, demand more ample provision. We have from the first occupancy of this building been one or two years behind our pressing needs in getting new shelf room. As pointed out in previous reports, this adds to daily cost of administration and takes away from convenience. The trustees have ordered new shelving on the sixth floor, but it will barely hold the overflow in that room to-day and will be insufficient for the year. We have now reached a point where we must have more shelves or begin boxing our books and making them inaccessible. This grave difficulty which I have pointed out annually since coming here is now fully upon us. The old building is not strong enough to carry the weight of central stacks, even if it were not fully occupied by the Library School. The north wall of the transept would hold five

thousand v. in two more galleries, which would at the same time give much needed access to the sixth floor. Beyond this there is absolutely no space available without encroaching on the floor of the great reading room or closing and filling with dark stacks the lower corridors. Extension of the building is possible only towards the north, as urged on the trustees in the President's report of last year. To use the floor now occupied by the Law School is the only alternative. To this there are two grave objections. Extravagance both in its limited capacity for books compared with its cost, whether considered as the cost of the present quarters, or as the cost of providing a new Law building; and more serious, the arrangement of the building is such that the lower floor can not be used as part of the library except by materially increasing the annual cost of administration. Long study of the problem compels me to urge strongly the economy of extending this building to the north, thus providing at once the cheapest storage for the future and the cheapest administration.

**Growth in books.**—Five years ago we had 50,000 volumes, counting all the various collections and all the duplicates. To-day there are over 100,000 v. in our building. During these five years we have had an annual appropriation of only \$6,700 and later of \$7,500, with the A. A. Low gift of \$5,000 in 1885. Our gifts of books are constantly increasing, and beginning the next year the trustees grant the professors' requests for the sums their departments demand as a minimum for books, a total of \$15,000 a year. To this should be added the recent special appropriations of \$750 for the books in science and \$500 for law. This increase is keenly appreciated, yet as I reported last year, \$20,000 is the smallest sum that will fairly meet the annual demands on us. Considering this growth of 50,000 v. in the first five years, the growth of the university; the growth of interest in the library, and of the demands made on it, it is not extravagant to estimate the increase for the next twenty years at 15,000 v. a year, or at 300,000 v. Building for less than twenty years with no provision for extension is simply

suicidal. A university library that stops growing is dead; for such a library hemmed in by other buildings, we have but two alternatives: Either all must be moved at enormous cost and waste or else other buildings must be torn down for the inevitable growth. To stop this rapid growth of the library is to stop the most important element in the university work of each department. A library, as much as the body, must be constantly fed. When fresh books cease to pour in, the old collection begins rapidly to lose its working value and to die. It is poor economy to let the whole body die from lack of needed food. Nearly every large library that has been built in the last generation has already found that insufficient allowance has been made for rapid growth. The conception of a library's functions has so changed that future growth is sure to be underestimated when judged by the past. I beg therefore again to record my opinion that immediate steps should be taken to protect this library against being smothered for lack of necessary room.

**Growth in use.**—Study of the annual tables will show remarkable growth; a growth marked in quality as well as quantity. "Every seat taken," was repeatedly reported to me last season. The trustees gave us forty more chairs, but they seemed to give little relief, for they were at once filled. The elevated reading rooms, asked and needed two years ago, and now ordered, will give space for fifty readers, but we have by no means reached our limit of healthful growth, and more space could be used at once to advantage.

**Gifts and additions.**—The gratifying list of gifts in the statistics shows that this source of growth may be depended on as constant. As prophesied, readers by courtesy are proving that the privilege so freely extended to them was bread cast on the waters. Many valuable gifts have already come from those who in this way sought to make some return.

The Huguenot Society of America has now deposited with us their library, which bids fair to become a famous collection in this department of history, as the Society is to make its development the important factor in their

future work. As the books are open to our readers, it is as valuable to us as if a gift. The Society in turn is able to spend its income in buying books instead of in rent and expenses of maintaining a separate library. Doubtless other learned societies will see the advantages of such deposit, and our central location, fire-proof building, long hours, and liberal administration will secure many valuable collections, since no library in the country can offer so many advantages to so many people.

**Staff.**—Over two years ago a prolonged examination was made by a sub-committee of the trustees with a view to reduce the cost of administration to the lowest possible point consistent with safety and reasonable convenience. They reported the minimum sum required, which was \$2,200, more than we received. In spite of this insufficient provision, for two years the library has grown steadily in use as well as in books, while in that time our Library School has been opened and carried on without any appropriation whatever from the trustees. As a result we have lost some of our most efficient assistants, and few of those that remain are properly paid. It has been of course impossible under such pressure to do justice to either School or library, and the measure of success achieved has been due to untiring efforts on the part of enthusiastic members of the library staff. Barely able to keep from serious arrears in current work, we have been forced to defer many of the important plans for helping our readers which we hoped to have put in operation. Probably I feel more keenly than any one else the desirability of making soon improvements demanded by the high ideal we set as our standard in opening this library in 1883. The appropriation for next year adds \$1,700 for salaries, but \$8,750 extra in new books will require exactly this extra sum in salaries (*i. e.*, one fifth the cost of books) to pay for buying, cataloguing, and preparing for use. We are therefore just as badly pressed as at our worst, just as it has happened in each case that from the time we asked for new shelving till it was finished we added as many books as it would hold,

so that the day the carpenters left their work we were as badly overcrowded as when we asked relief.

I note these facts not in complaint, for I appreciate fully the liberal spirit shown by the trustees towards that expensive necessity, not luxury, a good library. But it seems proper to record the facts which would be surely misunderstood by any one not very familiar with the circumstances.

My staff are willing to work hard and long, but, short-handed as we have been, much that we are anxious to do cannot be done till relief comes to the School or library, or to both.

**Bibliographical lectures.**—The scheme of having some professor or other expert give each Saturday at 10 A.M. a lecture open to all readers as well as to the Library School, has been developed further this year with most satisfactory results. In all 27 such lectures have been given with great profit, and the plan gives promise of increased usefulness in the year to come, when it is hoped to make them more widely known so that more may share their advantages. Thanks are due many professors for cordial coöperation.

During the year 20 lectures selected from the Library School course were given in the large rooms on the first floor. Some of them were crowded to the doors so that after standing-room was all taken, many were turned away. On topics of general interest a gratifying response has come to our invitations, and in this way our educational work has been enlarged without cost, for our class got no less benefit because over 300 others listened at the same time.

**Needs.**—Our persistent cry has been for more books, then for more room to shelve them, more room in which to read them, and more help with which to multiply their usefulness. Doubling the book appropriation this year gives us great encouragement, and will do much to remove the reproach of our advanced scholars that they must seek elsewhere many books that we should have at once on publication. The provision of the elevated reading-rooms must satisfy us for this year. But for more shelving and for more help

to teach in the School and to work in the library proper, the need is more urgent than ever before.

That we have so many needs is obviously only because the success of our first five years has been so much greater than was anticipated. The shelves provided held as many books as the college had gathered in 130 years, but at the end of five years they are overcrowded. The tables and chairs provided for readers held twenty times as many as ever used the old library. But now "every seat taken" has become a common report. Our monthly gifts average much more than the average annual gifts through the previous 20 years, and in all directions a similar phenomenal but healthful development has marked our first half decade. In view of these facts we are proud that we need still more shelving and tables and can use them wisely. Apology for such needs would be as unfitting as for a farmer to apologize for building new barns because his harvests had averaged double what he planned for or dared to hope.

Respectfully submitted,

MELVIL DEWEY,

*Chief Librarian.*

Columbia College Library, June 12, 1888.

*SUMMER CLASSES.*

**APPENDIX H.**  
**SUMMER CLASSES.**

**PRACTICAL WORK IN THE VACATION.**

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*To the President of Columbia College :*

I respectfully forward herewith the reports of Professor H. S. Munroe, one on the Summer School of Practical Mining, and the other on the Summer School of Surveying, for the last vacation.

The thoroughness and efficiency of instruction in these summer schools increases each year. They have been especially benefited by the employment of permanent assistants, otherwise employed in the School of Mines during term instruction. So great is the advantage of employing permanent assistants that to restore the former practice of engaging recent graduates and volunteer assistants, temporarily, would be a great step backwards. I do not mean to imply that such a step has been contemplated or suggested, but merely wish to state the decidedly beneficial effect of the present system as compared with the former.

I beg to call your attention especially to the report on the Summer School of Surveying. Students like Mr. Eilers and Mr. Weekes, whose work is especially alluded to by Professor Munroe, are competent to undertake immediately after graduation any kind of surveying employed in the government service; while all who pass through the course of surveying may become candidates for government positions connected with public surveys.

It is proposed hereafter to have all the computations and drawings connected with this summer school completed in



the field, so that when the students return to their term-work they will not be interrupted by any work of finishing their field-work computations.

Respectfully submitted,

W. P. TROWBRIDGE,  
*Professor of Engineering.*

Columbia College, April 13, 1888.

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## I.—SUMMER SCHOOL IN PRACTICAL MINING.

*To Professor W. P. Trowbridge :*

I have the honor to make the following report on the eleventh session of the Summer School of Practical Mining, held during June and July in the iron region of northern New Jersey and in the anthracite regions of Pennsylvania.

Mr. Ira Harvey Woolson, E.M. '85, Assistant in Drawing and Practical Mining, and Mr. Lewis H. Rutherford, E.M. '87, Honorary Assistant in Mining Engineering, served as assistants.

The head-quarters of the class for the study of iron mining was at the Richard Mine of the Thomas Iron Company, Port Oram, in Morris Co., N. J. Accommodations for the students were found at private houses in the vicinity.

The class assembled Monday, June 6th. The plan of work followed did not differ materially from that which has proved so successful in the past few years. The students, in squads of two, were divided among the different parties of working miners, and spent the day with them studying the details of mine-work, drifting, stoping, timbering, etc. They were required to submit their note-books for examination on coming out of the mine, which made it necessary that all their descriptive notes and sketches should be elaborated underground. The students thus avoid errors certain to creep in if they were permitted to compile their notes or make their sketches after reaching the

surface, trusting to their memory, or their imagination, for details.

The students were guided in their work by a printed scheme of study, and by daily lectures and conferences held in the mine-office before going underground. The professor and his assistants visited them in their working places during the day, for the purpose of explaining more fully the plans and methods of work, to point out subjects for sketches and description, and to aid them in systematizing their work. The frequent examinations of the students' note-books make it possible to correct mistakes, to point out omissions, and to indicate subjects requiring further or more minute study.

The students remained in the same working place, or with the same gang of miners, for several days, or until they had obtained a clear idea of the details of the work, and had made the required descriptive notes and sketches. They were then transferred to another part of the mine and assigned other subjects of study. The constant aim of the instructors is to make sure that the time of the student is spent to the best advantage, to see that his work is well directed, and that he takes full advantage of his opportunities. Without such assistance, the student might easily spend months underground, and not learn as much of the important details of underground work as in a few weeks of well directed and systematic study. The great advantage of having a permanent assistant attached to the summer school is evident. It is of the utmost importance that the student should not waste his time, but work intelligently from the start. The wider the experience of the instructor the more valuable will be his assistance and his explanations to the student.

As in past years, the greater part of the time devoted to the summer school was spent at one mine. It requires a certain time for the student to learn how to observe, what to observe, and how to record his observations. It takes him a certain time to become familiar with the work in progress underground, so as to recognize what is going on

about him. He requires some time to become acquainted with the officers and men, and familiar with the mine, so that he can find his way from place to place. Every week his work underground is better directed, and his observations more valuable. Finally, a thorough and careful study of one mine is the best possible preparation for work in another; so that even a short visit a week, or a day, at the second mine will be much more profitable than without such preparation.

An excursion was made to the Hibernian mines of the Glendon Iron Company, the head-quarters of the summer school in 1885. Here the class received a cordial welcome, and spent a day profitably in going through the workings with the mining captain, and in making sketches of mine plant and machinery.

A second excursion was made later to the mines of the Mount Pleasant Mining Company, and to other mines in the vicinity.

At the end of the first week in July, the work at the iron mines having been finished, the students were sent to the anthracite regions of Pennsylvania, for the study of coal mining. For this purpose the class was divided into small squads and assigned to different mines in the Lehigh and Wyoming regions. A printed scheme of study was given them, and they were required to submit, on their return, their note-books, with a detailed account of the mines visited, illustrated by sketches.

In concluding this report acknowledgment should be made of the kindness and courtesy of miners and mine officers at the different mines visited, and especially at the Richard mine, when we made so long a stay.

The faithful and zealous work of the assistants is deserving of more than a passing notice. The admirable work done by the students is a proof of the efficiency of their instructors.

Respectfully submitted,  
HENRY S. MUNROE.

Columbia College, April 10, 1888.

## II.—SUMMER SCHOOL IN SURVEYING.

*To Professor W. P. Trowbridge:*

I have the honor to make the following report on the fourth session of the Summer School of Surveying, held during August and September at Litchfield, Conn.

Mr. Ralph E. Mayer, C. E., '79, Assistant in Drawing and Surveying, Mr. Wm. H. Stuart, C. E., '86, Fellow in Engineering, Mr. L. H. Rutherford, M. E., '87, Honorary Fellow in Practical Mining, and Mr. Lea M. Luquer, C. E., '87, now Fellow in Mineralogy, constituted the corps of assistants authorized by resolutions of the board of Trustees.

We were fortunate this year in securing a very efficient body of instructors, whose work contributed not a little to the permanent improvement of the course of instruction, and whose faithful and zealous performance of the duties assigned is worthy of great praise. In addition to the regular corps of assistants Mr. Karl E. Eilers and Mr. Edward F. Weekes rendered valuable service. These gentlemen volunteered to take a supplementary course in surveying, and gave much of their time to the instruction of their classmates, and to field work and computations that would otherwise have fallen on the regular corps of assistants.

The following students attended the summer class, as required:

Robert L. Allen,	Arthur S. Mahoney,
Romeo T. Betts,	Chas. G. Massa,
Robert G. Brown,	Louis F. Massa,
Elbert P. Callender,	Thomas M. R. Meildeham,
Theodore C. Coykendall,	Joseph T. Monell,
Fred. W. Denton,	William Murray, Jr.,
Daniel L. Dresser,	Isaac H. Oseransky,
Karl E. Eilers,	Charles Piez,
Augustus V. Ellis,	George S. Percival,
William H. Erb,	A. L. Pittinger,
Francisco Escobar,	Albertson V. Post,
Willard Fisher,	William E. Preston,
William H. Freedman,	Andrew J. Provost, Jr.,

Albert C. Fowler,	Robert M. Raymond,
Andrew E. Foye,	James L. Schroeder.
Maurier G. Gennert,	Augustus Smith,
Stanley D. Gifford,	Charles W. Stoughton,
Thomas H. Harrington,	R. H. Syms,
Frederich A. Heinze,	James B. Taylor,
George J. Hicks,	H. W. Tiemann,
Marmaduke B. Holt,	Edward Van Volckenberg,
Arthur S. Ives,	Gustav J. Volckening,
Reginald F. Jopling,	Edwin H. Wedekind,
Henry Lipps. Jr.,	Edward F. Weekes,
Thatcher T. P. Luquer,	Herbert P. Whitloch.
Total, 50 men.	

Of the above, nine men were students of the present fourth class, who had been unable to attend the summer school of surveying with their own class, or who had failed to complete the course owing to conditions in other studies which made it necessary for them to leave Litchfield before the end of the session.

Twelve of the above fifty men were volunteers, mostly from the present second class. These were picked men who were allowed to anticipate their surveying in order that they might be able to devote the coming summer to the class in Mechanical Engineering, and to other work. One volunteer is a fellow of the School of Arts, and the remaining two were students taking a supplementary course.

Thirteen students were debarred from attendance under the rule excluding conditioned men. Of these but two have been able to go on with their class, five have been dropped to the class below, and six have left the school.

Ten students, less heavily conditioned, were given permission to attend the class. Two of these men failed to report themselves, and three were obliged to leave Litchfield without completing their work. Five only of the conditioned students remained with the class to the end and completed the work required.

Beside the two absentees above noted, one other student, without condition, failed to attend.

The by-law adopted last spring by the faculty ; by which students failing to complete the work of the summer school of surveying, are debarred from attendance on the summer schools of Practical Mining and Geodesy ; has lessened very much their irregularities of attendance. There are but five men in the present third class who have not taken the surveying course, about half the usual number, and of these two were debarred men.

The new by-law had also the effect of preventing the conditioned men from leaving their surveying work as early as heretofore. Last year six men left before the end of the session, four at the end of two weeks, and two at the end of the third week. This year but two conditioned men left, and these only at the end of the third week.

The large size of the class, viz., 50 men, as compared with 41 of the year before, and the fact that but few left before the end of the session, taxed the outfit of surveying instruments to the utmost. It was necessary to adjust the work of the different squads very carefully in order to keep every instrument actively in use. On several occasions squads had to wait a day or two for instruments, in order to continue their work. This difficulty is not likely to arise this year, as the liberal appropriations for new instruments will enable us to make the outfit large enough for present requirements.

The surveying work required of each squad was essentially as detailed in the handbook, and as given in previous reports. The students worked in squads of two men, except on the hydrographic survey, when the number was increased to six.

An unusually large number of rainy days shortened somewhat the time available for field work. This necessitated some slight changes in the course. The topographical survey by the rectangular method, with compass and chain and hand-level, was again omitted, and some of the other exercises were shortened.

Considerable prominence was given, as heretofore, to surveys by pacing, and with simple instruments. Such methods are exceedingly useful to the engineer in all reconnoissance

work, and the educational value of these simple surveys can hardly be overestimated. The student's attention is not absorbed by the manipulations and adjustments of the more exact instruments, and can devote himself to the surveying problems he is called upon to solve. Such surveys are quickly executed, so that the student gains much practice in the location of points and lines, under all possible conditions. These rough surveys illustrate the principles of surveying as well as more elaborate exercises, and serve as an admirable introduction to the work that the student is called upon to do later in the course.

These rough surveys are followed by practice with the transit, level, and plane table. The student is first required to put the instrument in perfect adjustment. Then he is given simple exercises to familiarize him with its manipulations; and finally he is required to make a number of surveys, using stations whose position has been accurately determined. In these practice surveys such a degree of accuracy is required as shall insure that the student has used correct methods, and has been careful in his work. The very elaborate system of such surveys required for this purpose throws considerable labor on the professor and his assistants, but in no other way can the student be taught the necessity for care and attention to detail in his work. The possibility of checking every station, and almost every observation made by the student, is of the utmost importance. It is not necessary to wait until the survey is finished, and the result computed, or the plot made, to determine whether the work has been well done; but carelessness or improper methods can be detected at the very beginning. This not only saves the student's time, by lessening the work that he will have to do again, but it is of direct advantage to him in that he is not allowed to become confirmed in incorrect methods and ideas, which must be unlearned. At the same time care is taken not to encourage the student to depend upon these checks. He is not told at what station, or in what course, he has made an error, but is required to repeat a certain one third, or one quarter, of the survey. And,

again, he is not allowed to repeat a survey or part of a survey, indefinitely. At each repetition an assistant is detailed to watch carefully the work of the squad, to detect and point out, if possible, the source of previous errors. If the correct result is not obtained the second or the third time, the squad is assigned some other work. If the students were allowed to repeat their work indefinitely they would have less incentive to careful work, they would become discouraged and perhaps careless, they would waste a great deal of time that might be more profitably employed, and finally it might easily happen that they would arrive at the correct result by a happy accident, and in spite of incorrect methods of work.

The amount of work that is accomplished by a class of average size in six weeks of systematic and uninterrupted work is very great. A class of say forty men, or twenty surveying squads, will make 140 surveys aggregating over four square miles in area. They run about sixty miles of levels, with hand levels, water levels, and engineers' wye-levels. Including soundings they determine the level of nearly 5000 stations. Including the preparatory exercises they measure over 400 miles of lines by pacing, chaining, and with tape or telemeter. In their several surveys they occupy 1600 stations with compass, transit, or plane table, and make over 20,000 angular measurements. In these surveys they determine the position of about 50,000 points.

Messrs. Eilers and Weekes, who volunteered to take a supplementary course in surveying, accomplished some very interesting work. They made a detailed reconnoissance of the country about Bantam Lake, and as far north as Litchfield. They selected a base line, and located a number of primary stations by triangulation. From these stations they determined a large number of secondary points, buildings, flag poles, plane-table signals, etc. Finally they ran the roads with the odometer purchased last year, and made a map on a scale of 1 : 4000. This map will serve as a basis upon which to plot the plane-table sheets which have been made during the last three years.



As a preparatory step for the measurement of their base line, Messrs. Eilers and Weekes undertook the computation of a new table of catenary corrections; the old table having been computed for a lighter tape than those now used in the school. A 500-foot tape was stretched at the standard tension of 20 lbs., and the deflections from a straight line were determined at numerous points by means of a level. These observations were repeated a number of times in order to reduce the probable error. As a further check the equation for the curve was computed from the observed results, and the several deflections recomputed from the equation. It was found that a parabola  $y^2 = 6667.5x$  coincided with the catenary within the limits of probable error of the observations. It was also found that the arc of a circle with a radius of 3284 feet, coincided so closely with the catenary that it could be used for computing the necessary table of corrections without introducing any measurable error. The radii of circular arcs corresponding to different portions of the catenary, vary between 3281 and 3288 feet, and the error introduced by using a circular arc of 3284 feet radius does not exceed 0.001 foot with the full length of tape in use.

The table as computed by Messrs. Eilers and Weekes, gives the difference between arc and chord for catenaries from 10 feet to 500 feet, for each 10 feet. The computations were checked by second differences, and verified by crucial measurements in the field.

Two measurements were made on their base line by Messrs. Eilers and Weekes. Corrected for temperature, inclination, and catenary, the results were 2842.986, and 2843.019, respectively. The probable error of the mean is thus, 0.008, or less than three millionths part of the length. These measurements were made rapidly, and without special appliances. The tape was stretched by hand to the standard tension of 20 lbs., and the readings were taken between plumb lines at the end of the several lengths of tape used.

The triangulation was done with ordinary engineers'

transits. The expansion from the base was by quadrilaterals, and was quite rapid. Nevertheless, the probable error on the longer lines did not exceed a few inches.

The preliminary work and the triangulation occupied so much time that it was not possible to do as much topographical work as was at first intended. Nevertheless fifteen or twenty miles of road were run with the odometer. With a larger number of students it would have been possible to organize a course of practical work, which should include all the principal topographical methods applicable to state surveys, from the rough and rapid methods with pedometers, odometers, compass, and aneroid; to the more refined methods with transit or plane table, and the determination of heights by vertical angles or leveling.

In view of the number of state surveys projected and actually organized, and in progress, it is hoped that other students will decide to undertake similar volunteer work this coming year, that a course in topographical surveying may be instituted to supplement the geodetic work now carried on under Professor Rees, in the Summer School of Geodesy.

Respectfully submitted,

HENRY S. MUNROE.

Columbia College, March 10, 1888.

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### III.—SUMMER SCHOOL IN MECHANICAL ENGINEERING.

*To the President of Columbia College :*

I respectfully transmit herewith the report of Professor F. R. Hutton on the Summer School in Mechanical Engineering for the last summer vacation.

At the last meeting of the Faculty of the School of Mines a vote was passed, at my suggestion, asking the trustees to appropriate five hundred dollars for the purpose of carrying on this school, and I hope that the trustees may kindly grant the request.

Professor Hutton has conducted this summer school without assistance and at a good deal of disadvantage and extra work on his part for about ten years. The results of these summer exercises have been most excellent; but Professor Hutton needs assistance such as is provided in the other summer schools, and a small fund for incidental expenses.

Respectfully submitted,

W. P. TROWBRIDGE,

*Professor of Engineering.*

Columbia College, April 3, 1888.

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## REPORT.

*To Professor W. P. Trowbridge :*

I have the honor to present the Report of the tenth year of the Summer Class in Mechanical Engineering in the machine shops of this city.

The class was again organized upon the methods which have been found so satisfactory in previous years and with the same objects. It is not intended that the students shall acquire the dexterity of the artisan and his skill in the handling of his tools, but rather that they shall gather such a general understanding of shop processes and methods as to be able to take account of the principles in design and execution which are imposed by these conditions. The method of study is therefore to study in close detail the carrying out of each and every process which is employed in the several departments of a large works during the interval of a visit of several weeks there. The students attend attired in overall suits so that they will not be afraid of soil, and are expected to watch critically each step of the workmen's labor, and to ask such questions of the instructor as shall enable them thoroughly to comprehend the reasons for every thing which they see.

It has been found, however, that the ordinary student, from ignorance and inexperience in observation, will be very likely to miss points of great technical interest, unless these

are specially pointed out to him, as matters for study. To accomplish this end, it has been found convenient for the instructor to assemble the class at the beginning of the day, and discuss in a preliminary chat, the topics for that day. To serve as a groundwork and syllabus for such pioneer work a printed outline of study is given to each man, and from this he deduces the topics which he should investigate. A copy of this "Outline" is appended hereto. But even with this guide, it is to be regretted that insufficient assistance to the instructor in charge (it is impossible for one man to distribute himself equally to every group of students) must explain why the less observant men were not compelled to derive more benefit than they did. In an establishment covering parts of two city blocks, there ought to be at least two assistants beside the chief instructor, for the securing of the full value of the opportunities offered to a class of over a dozen men. It is hoped that for another year, some provision may be made for such an improvement in method.

The class were again privileged to pursue their study at the Delamater Iron Works, C. H. Delamater & Co., West 13th St. and North River. The writer would again express his indebtedness for the courtesies which were extended to him and to the college. Work was begun on June 6th at the close of the final examinations in the School. The limit number of twenty was not reached this year again, on account of the pressure from the other summer school assigned to the latter part of the same summer, and for other reasons. The weather in June was fortunately cool and bracing, although towards the end of the interval the cycle of humidity gave signs of its approach and made the labor by so much more fatiguing. The labor troubles of the spring had also produced an unsettled state of feeling and several large contracts were not assumed for these reasons, which caused a less amount of large work to be on hand. The foundry was, however, as busy as ever, and as instructive, and the departments of contract manufacture of pump-engines, etc., were also in full swing.

No excursions were attempted away from this one establishment, since the policy of the class, and preference of those in attendance, was on the first part to do thoroughly that which was undertaken, and on the other part to work assiduously and get through and secure needed recreation. In reference to this desire, and by taking each day a little longer allowance of labor, it became possible to adjourn the class after fifteen days of consecutive visit. Several came also upon the Saturdays for the benefit of such extra opportunities as were thus given. But the true purposes and intent of the class are not best subserved by this plan, inasmuch as part of the fundamental idea of the class is to secure the daily presence of the students in the works for a sufficiently extended interval to enable every one to have had a chance to see the widest range of occurrences and the methods of meeting emergencies of varied classes. While a few weeks can admit of only a small proportion of the events which are likely to occur in a shop during the year, yet on the other hand, the student is not in the shop long enough to have the interest and charm of novelty dulled by frequent repetitions of identical cases, and the few weeks of such experiences is much better than none. The class adjourned at the end of its allotted time with warm expressions of their interest and sense of having been benefited.

The writer would also take occasion in closing to express his indebtedness to Mr. Geo. Rowland, graduate of the Class of 1887 in the School of Mines for his volunteered assistance at the class, which was rendered without compensation and did much to lighten the labor of the clinical instruction in the different parts of the shops where the processes were carried on.

Respectfully submitted,

F. R. HUTTON,

*Adj. Prof. Mechanical Engineering School of Mines.*

The outline of study, and the Roll of Class of 1887 are appended.

Columbia College, April 5, 1888.

## MECHANICAL ENGINEERING.

# MECHANICAL ENGINEERING.

### SUMMER CLASS.

## SCHOOL OF MINES, COLUMBIA COLLEGE.

### NECESSARY OUTFIT.

- One pair outside calipers (4 inches).
- One brass-bound rule (2 feet) graduated to  $\frac{1}{16}$  inch.
- One pair blue drilling overall pants.
- One note-book (3 x 6 inches or over), pencil or Stylograph.

### PLAN OF STUDY.

Each student will attend with note-book at the appointed shop, from nine to four.

He will study closely and critically the machinery, tool, or process which has been for that day the topic of the clinical lecture by the instructor, taking full notes and illustrating them with free-hand sketches, with DIMENSIONS IN ALL CASES. Where the object is inaccessible (*e. g.*, roof-trusses), estimate dimensions by eye, and write "approx." under the title.

Students will also seize every opportunity to draw and describe all details of engines, and machinery in process of construction which are accessible to measurement. Such are—boilers, pistons, cross-heads, cranks, pillow blocks, valves, wheel arms, connecting-rods, eccentrics, stubs, governors, walking beams, galleys-frames, propellers, paddle-wheels and such engine castings as valve-chambers, cylinders, bed-plates, etc.

It is intended that these note-books shall be the first of that series which every engineer will have, containing memoranda and "studies" of parts of machinery and constructions to which he may refer in his practice. It would be well in the evening of each day to work over the sketches of the day at home into a clean note-book for more permanent preservation.

### OUTLINE OF COURSE OF STUDY.

#### I. BOILERS.

Describe the boilers; types, sizes, shape and length; how set; grates; domes; steam-chimneys, man and hand-holes, tubes and flues; size and height of chimney, course of gases from fire; diameter and length of steam pipes joints; support; lagging. Feed-pipe; feed-heater; blow-off pipe; sizes; valves

and apparatus. Gauges for water and steam. Pressures. Boilers over heating furnaces.

Study position of boilers with respect to :

- (1) Cooling and removal of ashes.
- (2) Delivery of smoke.
- (3) Condensation of steam.
- (4) Danger from fire and explosion.
- (5) Superintendence.

## 2. ENGINES.

Kinds : sizes and proportions of cylinders ; Rpm., stroke, piston speed ; point of cut off ; slide-valves, mechanism ; fly-wheel structure ; steam and exhaust pipe ; lubrication of cylinders and bearings ; governors, condensers.

Study position of engines with respect to :

- (1) Distribution of power.
- (2) Ease of attendance, etc.
- (3) Duties of engineer.

## 3. DISTRIBUTION OF POWER.

Sizes, speeds of main belt ; sizes of main pulleys ; sizes, speeds and location of main shafts ; couplings ; hangers, forms, intervals and lubrication.

Motion to shaft at angles ; use and structure of counter shafts.

*Pulleys* : Sizes, faces, arms, securing, oiling, clasp pulleys, guide-pulleys,

*Belts* : Kinds, sizes, speeds, lacings, shifters, tighteners, open and crossed.

Other transmissions, by rope, chain, universal joint, flexible shafting, etc.

## 4. MACHINERY FOR HANDLING HEAVY WORK.

### TRAVELLING CRANES.

Support of rails ; trussing of crane-girders ; span ; speed of lift and of travel speed of driving rope ; capacity ; gearing and tackle used ; proportions of parts ; method of driving and controlling crab.

### PIVOT CRANES.

Location ; span ; height ; bracing ; foundation, structure and movement of buggy ; hoisting-gear ; capacity and speed of lift ; men required. Power cranes, motions and control.

### HOISTS AND TACKLING.

Situation ; dimensions ; capacity ; construction ; handling.

### TELEGRAPHS.

Fixed and pivoted. Trolleys and capstans.

## 5. CARPENTER AND PATTERN SHOP.

Study wood-working machine-tools.

*Saws* : Slitting, cross-cut, band and jig. Lathes, beds, speed and wing, and face-plates.

*Planers, Matchers* : Bed, carriage and speeds, feeds and capacities of each.  
 Study hand-tools—what are they and how used.  
*Shrink-rules* : glues and varnishes and their preparation ; draught.  
 Division of patterns, dowels, core prints and core-boxes. Draw irons.  
 System of storage of patterns.  
 Elements of expense of patterns.

#### 6. IRON FOUNDRY.

Size, shape, structure, foundations, lining of cupolas.  
 Capacity, charging, lift, mixtures, starting fires, tapping, dropping out.  
 Blast, pressure, how introduced, kind of blower.  
*Ladles* : Form, size, structure, handles, tipping-gear.  
*Sands* : Green, dry, facings, core-material, forming and baking. Washes.  
*Flasks* : Cope, drag or nowel, loam casting, sweeps, core-lathe, cleaning  
 and pickling castings, rumbles.  
 Study processes of moulding, forming gates and supporting cores.  
 Study processes of casting, skimming, avoiding shrinkage, strains, and explosions,  
 Note times necessary and economy of close casting.  
 BRASS FOUNDRY.—Alloys, moulds, furnaces and crucibles.

#### 7. FORGING.

HEAVY.—Furnaces, blast, hammers, anvils and foundations.  
 Cranes—support, adjustment, and control.  
 How a large forging is built up and completed. Porter bar, time and men required. Upsetting, cutting off.  
 LIGHT.—Forges, kinds of fuel and fires, blast.  
*Hammers* : Steam and power.  
*Hand-tools* : Sledges, hammers, anvils, tongs, swages, chisels, flatters, fullers.  
*Processes* : Heating, welding, upsetting, scarfing, fluxes, peining.  
 Tongue, scarf and butt welds. Drawing down, bending, cutting-off, punching in small bars.  
 Tempering and forging of steel.  
 Flanging of plate— anvils, mauls, vices, fires, etc.  
 Economy from close forging.  
 COPPER SHOP.—Brazing, galvanizing, spinning, babbiting.

#### 8. BOILER SHOP.

Shearing, beveling, marking, punching, drilling, boring, bending of plate.  
 Riveting, by hand and machine, drifting, reaming, calking, expanding tubes, cutting off and heading over.  
 Times required in each process.

#### 9. METAL WORKING MACHINE TOOLS.

Latches—Drills—Vertical lathes and boring machines, horizontal and vertical ; turret lathes, bolt threaders and nut tappers.



Planers—Shapers—Slotters.

Milling machines, gear cutters, profilers.

Emery wheels and grindstones, speed at surface. Buffing wheels.

Study :

(1) Motions of tool and work. How produced. Back-gear ; cone-pulleys, quick returns. Rpm. and speed, screw cutting.

(2) Centring and chucking. Time required. Forms of chucks, face-plates, dogs, and drivers ; steady rests. Centring machines.

(3) Cutters—Forms, temper, cutting edges, spring, nature, and weight of chips, inaccessible places. Rotary cutters.

(4) Tool-rests and holders—motions, methods, and directions of feed, depth of cut, time to finish one square foot.

(5) Boring bars and heads, star wheels. Use of open and solid dies for screw cutting.

Roughing and finishing out. Water finish.

#### 10. BENCH WORK OR FITTING.

Hammers : Chipping by cold and cape chisels. Lining out. Centre punching.

Files : Sections, bastard, smooth, dead smooth, second-cut, safe-edges, draw-filing. Grinding, surfacing, marking, scraping. Tapping and pipe-fitting by hand and machine, dies and stocks.

#### 11. FLOOR WORK OR ERECTING.

Ratchet, hand and breast drills ; fly and twist drills.

Portable boring bars, mills and drills. Extension and flexible shafting.

Standing bolts, socket nuts ; wrenches. Assembling presses.

#### 12. SUPPLY AND TOOL ROOMS.

Contents, system, repairs, gauges.

#### 13. DRAWING ROOM AND OFFICE.

Equipment and labor. Time-keeping. Account system. Paying. Shop rules. Contract system. Superintendence. Helper system. Laborers.

#### 14. GENERAL ENGINEERING FEATURES.

Sketch a ground plan of the plant (dimensions by paces) ; prepare, also, ground plan of each shop, showing position of each tool in it, with yard spaces and areas around each tool noted.

STUDY PRINCIPLES OF ARRANGEMENTS OF BUILDING WITH RESPECT TO :

- (1) Transmission of power.
- (2) Progress of work through the shops.
- (3) Superintendence.
- (4) Ease of shipment of goods.

STUDY STRUCTURE OF BUILDING WITH RESPECT TO :

- (1) Solidity to uphold shafting, etc.
- (2) Foundations and roof-trusses, floors, etc.

- (3) Combustibility in case of fire.
- (4) Windows, lighting and ventilation.
- (5) Convenient arrangement of tools.

F. R. HUTTON,  
*Adj. Prof. Mechanical Engineering,*  
*School of Mines, N. Y.*

ROLL OF THE CLASS, 1887.

Brown, Denton, Eilers, Escobar, Fearn, Gifford, Harrington, Heinze,  
Holtz, Ives, Massa, Oseransky, Raymond, Smith, A., Stoughton, Weekes.

#### IV.—REPORT ON SUMMER SCHOOL IN PRACTICAL GEODESY.

*To the President of Columbia College :*

I have the honor to submit herewith my report on the work of the Summer School in Practical Geodesy for the summer of 1887. The class began work on June 6, 1887, at the Observatory, and continued Observatory work until June 27th.

On July 1st, the class reported for work to me at Cooperstown, N. Y., and remained there until July 21st. The work accomplished this summer was similar to that reported last year.

The State Engineer of New York, Hon. Elnathan Sweet, loaned us a fine direction instrument belonging to the State Survey. I was assisted by E. L. Stabler and L. M. Luquer in the Observatory, in the field and in checking the calculations. In the last named work R. L. Allen also aided. The class at first numbered twenty-one; but was subsequently diminished by the withdrawal of four students. Besides the Observatory and the field work, the students were required to write memoirs on the following subjects, which were assigned to them as shown below :

- I.—Western Union Time System : Messrs. Bartlett and Miller.
- II.—The Standard Time System now in use in the U. S. and Canada :  
Messrs. Koen and Schumann.
- III.—Synchronizers ; Electric, Pond's, Hamblet's, etc. : Messrs. Gardner and Maclay.
- IV.—Sympathetic Clock Systems, Pneumatic, Electric, etc. : Messrs. Berry and Comstock.

- V.—Several modern methods of construction of escapements for fine astronomical clocks; compensating pendulums; barometric corrections: Messrs. Ellis and Herbert.
- VI.—Chronographs; their construction, connection with clocks, pens and batteries; also self-printing forms: Messrs. Lipps and Percival.
- VII.—U. S. C. S. methods of comparing base bars with standards: Messrs. Parsons and VanVolkenburgh.
- VIII.—Automatic methods of recording meteorological observations: Messrs. Murray and Sturgis.
- IX.—Machines for graduating circles: Messrs. Gould and Post.
- X.—Complete description (with drawings, cross-sections, etc.) of a direction inst.: Messrs. Restrepo and Tower.

The memoirs handed in show in many cases painstaking care to get original information. This was especially the case in memoirs numbered (1), (4), (6) and (7). One student travelled nearly 2,000 miles to see the new self-printing chronograph by Professor Hough at Chicago. Others went to the U. S. Coast Survey office at Washington to study the comparing apparatus on the ground.

I submit with this report

- (a) A copy of the scheme of work,
- (b) Blanks used for calculations of observations,
- (c) Records of base line measurements and their reductions.
- (d) Records of angle measurements by repetitions and by directions.
- (e) The sets of calculations by each student on the various pieces of work demanded by the scheme.
- (f) The memoirs thus far handed in.

Respectfully submitted,

J. K. REES,

*Professor of Geodesy and Practical Astronomy.*

## VI.—SUMMER SCHOOL IN CHEMISTRY.

*To the President of Columbia College:*

I have the honor to make the following report with regard to the Summer School in *Chemistry*:

The Summer School in Chemistry was open from the 15th of June to the 15th of September, in charge of Henry C Bowen, Edward W. Martin, and Herman T. Vulte, Ph.D., under the general supervision of Professor P. deP. Ricketts.

Twenty (20) students entered to pursue Qualitative Analysis, two of whom subsequently pursued Quantitative Analysis.

Twenty-eight (28) entered to pursue Quantitative Analysis, beside the two above mentioned, making forty-eight (48) students in all in attendance.

Of these forty-eight (48) students thirty-two (32) were students already in attendance in the School of Mines, seven (7) were members of the class which graduated in June, and nine (9) were special students who had not previously been connected with the School.

The total expenses of the Summer School amounted to \$999.40; the receipts were \$730.

The work accomplished by the students in the Summer School was eminently satisfactory, both to the pupils and the instructors. It is believed that had the School been properly advertised two or three months in advance a very much larger number of special students would have availed themselves of the opportunities which it offered, as we frequently receive applications for this kind of instruction from persons who are engaged in teaching during the other seasons of the year.

Very respectfully,

C. F. CHANDLER,

*Professor of Chemistry.*

Columbia College, March 9, 1888.

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REPORT  
OF THE  
ACTING PRESIDENT  
OF  
COLUMBIA COLLEGE  
FOR THE YEAR 1888-89

MADE TO THE  
BOARD OF TRUSTEES

JUNE 3, 1889



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1889

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## THE ACTING PRESIDENT'S REPORT.

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### TO THE TRUSTEES OF COLUMBIA COLLEGE :

The Acting President begs leave to present to the Trustees the following statement of the operations and condition of the College for the academic year 1888-89.

Owing to the failing health of Dr. Barnard, for so many years the able and distinguished President of the College, early in the year 1888 the duties of his office devolved, under the statutes, on the Senior Professor. From continued and increasing infirmity the President felt constrained to submit to the Trustees, at their meeting in June of that year, the (conditional) resignation of his high office. "To secure to him a full measure of relief from his duties and responsibilities as President and Trustee, the Trustees granted to him leave of absence for one year," and formally constituted the Senior Professor Acting President of the College, relieving him at the same time for the coming year of all professorial duty.

After the summer vacation the College reassembled in the week preceding the first Monday of October for the examination and matriculation of students. The regular exercises began promptly on the following Monday (October 1st) in all departments.

The work of the College has been carried on during the past year in the several Schools, each devoted to its appropriate subjects of instruction, viz., the Schools of Arts, Law, Mines, Political Science, and Medicine, to which were

added the Collegiate Course for Women, and, in connection with the library, classes for instruction in Library Economy.

*Attendance.*—The total number of students in all the Schools of the College is somewhat less than that of last year. The decrease has been in the School of Medicine, where there was an unusually large increase last year. The entire number for 1888–89 is seventeen hundred and sixty-eight, while for 1887–88 it was eighteen hundred and twenty-nine, as against fifteen hundred and seventy for 1886–87. There has been a slight increase in the Schools of Arts, Mines, and Political Science, and a considerable increase in the School of Law.

*School of Arts.*—The number of students in attendance in the course of the year has been two hundred and thirty-seven; for the previous year, two hundred and twenty-eight; and for 1886–87, two hundred and thirty. The distribution in the several classes is: Freshmen, eighty-two; Sophomores, sixty-nine; Juniors, fifty; and Seniors, thirty-six. Three students have been withdrawn; deducting these and thirty-four members of the graduating class, there will remain on the rolls two hundred, as against one hundred and eighty-two in last year's report. Forty students failed to matriculate in October last, while eight rejoined their classes or were added in the course of the year. Some of those who fail to return at the end of the Junior year enter as students in the first year of the School of Political Science.

*School of Mines.*—The number of regular students in the School of Mines for the year has been two hundred and twenty-nine, for the previous year two hundred and twenty-four, distributed as follows: In the First Class, seventy-four; in the Second Class, fifty; in the Third Class, fifty-one; and in the Fourth Class, fifty-four. Nine students have ceased to attend. If, in addition to these, the whole Fourth Class graduates at the end of the year, the number remaining will be one hundred and sixty-six.

Besides the regular attendants, four Juniors and Seniors

from the School of Arts elected studies in the School of Mines; there were in the Summer School of Chemistry thirteen, and in the Summer School of Photography four.

*School of Political Science.*—It is somewhat difficult in this School to give exact numbers of the whole or of the separate classes, as most of the students are members of the Law School, and members of different classes sometimes attend the same lectures. The total number on the rolls is sixty-nine, classified as follows: Students of first year, eighteen; of second year, thirty-one; of third year, five; and special, taking partial courses, fifteen.

Of the sixty-nine students enrolled, forty-one are college graduates from fifteen institutions, of whom eighteen are from Columbia, five from College of City of New York, four from Williams, and no more than two from any other college, showing that by far the greatest source of supply of college graduates is from Columbia.

*School of Law.*—The number of students in the School of Law for the present year is four hundred and ninety-two; in the Senior Class two hundred and forty-four, and in the Junior Class two hundred and forty-eight. The graduating class of 1888 numbered one hundred and fifty. Among the students of the School fifty-two colleges are represented by two hundred and thirty-five graduates as follows: From Columbia, fifty-two; Yale, twenty-nine; College of the City of New York, twenty-one; Harvard, twenty-one; Williams, twelve; Princeton, ten; the others in smaller numbers. These figures show that Columbia supplies a larger number of students to the Law School than any other two institutions taken together.

*School of Medicine.*—The number of students in the School of Medicine is seven hundred and two, against eight hundred and nine last year. The reason of the diminution of both applicants and admissions (one hundred and seven) was owing to the establishment of an entrance examination in English, Latin, Arithmetic, and Algebra, and an extension of the time of attendance and of the course of study.

Of the whole number (seven hundred and two), two hundred and thirty-seven possessed degrees: from Colleges of Arts, Philosophy, etc., one hundred and ninety-nine; in Medicine, thirty-eight.

*Collegiate Course for Women and Course in Library Economy.*—In the Collegiate Course for Women there are twenty-five students, of whom three are candidates for a full degree. In the Course in Library Economy there have been in the current year thirty-two students, divided into two classes.

*Graduate Department.*—In the graduate department of the School of Arts twenty-eight students are pursuing the graduate courses leading to the degree of A.M. and Ph.D., besides five in the Collegiate Course for Women, and in that of the School of Mines there are nine (9) such students

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	—	69
School of Medicine . . . . .		702
In Course of Library Economy . . . . .		32
		—
		1824
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		—
		1768

# DEGREES.

9

## DEGREES CONFERRED IN 1887-88.

In the year ending June, 1888, the following degrees were conferred :

### IN THE SCHOOL OF ARTS.

Bachelor of Arts . . . . .	45	
Master of Arts . . . . .	4	
Doctor of Philosophy . . . . .	7	
Doctor of Letters (honorary) . . . . .	1	
	—	57

### IN THE SCHOOL OF MINES.

Engineer of Mines . . . . .	5	
Civil Engineer . . . . .	13	
Metallurgical Engineer . . . . .	2	
Bachelor of Philosophy . . . . .	23	
Doctor of Philosophy . . . . .	2	
	—	45

### IN THE SCHOOL OF POLITICAL SCIENCE.

Bachelor of Arts . . . . .	3	
Bachelor of Philosophy . . . . .	4	
Master of Arts . . . . .	21	
Doctor of Philosophy . . . . .	1	
	—	29

### IN THE SCHOOL OF LAW.

Bachelor of Laws . . . . .	150	150
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### IN THE COLLEGIATE COURSE FOR WOMEN.

Bachelor of Arts . . . . .	1	1
----------------------------	---	---

### IN THE SCHOOL OF MEDICINE.

Doctor of Medicine . . . . .	115	115
Grand Total . . . . .		397

*Residences of Students.*—The students from New York City and Brooklyn are entered separately; those for the State of New York, therefore, are exclusive of these two cities.

## RESIDENCES OF STUDENTS.

Residence.	School of Arts.	School of Mines.	School of Pol.Sci.	School of Law.	School of Med- icine.	Gradu- ate De- partm't.	Course for Women	Totals.
New York City...	109	109	28	213	208	21	15	703
Brooklyn .....	41	39	9	64	49	5	4	211
New York State...	45	25	9	77	121	5	4	286
New Jersey.....	33	27	8	49	89	2	1	209
Alabama.....		1		2	2			5
Arkansas.....					2			2
Bermuda .....					1			1
California.....				4	7	1		12
Canada.....		1		1	3			5
Central America..					8			8
Colorado.....			1	1	1			3
Connecticut .....	3	3	4	12	45		2	69
Cuba.....		3			4			7
Dakots.....					2			2
Dist. of Columbia.				2	3			5
England.....				1				1
Florida.....					1			1
Georgia.....				1	4	1		6
Idaho.....		1	1	1				3
Illinois.....	2	2	1	5	7			17
Indiana.....				2	1			3
Iowa.....		2	1	2				5
Italy.....					1			1
Kansas.....			1	3	3			7
Kentucky.....	1			1	1			3
Louisiana.....		2		2	2			6
Maine.....				2	3			5
Maryland.....		1		2	1			4
Massachusetts....			1	6	22			29
Michigan.....				1	2			3
Minnesota.....		1		2	7			10
Mississippi.....					1			1
Missouri.....	1			4	3			8
Montana.....		1			3			4
Nebraska.....			1	1	1			3
Nevada.....				1				1
New Brunswick...					3			3
New Hampshire...				2	8			10
North Carolina...		1			5	1		7
Nova Scotia.....					1			1
Ohio.....	1	3	2	5	7			18
Oregon.....				2	6			8
Pennsylvania.....		1		7	14	1		23
Porto Rico.....					1			1
Rhode Island.....		2		3	19			24
South Carolina...					2			2
Sweden.....					1			1
Tennessee.....				1	3			4
Texas.....				1	7			8
Turkey.....					1			1
U. S. of Colombia.		1			1			2
Utah.....	1							1
Vermont.....				3	1			4
Virginia.....		2			8			10
West Virginia.....					1			1
Wisconsin.....			1	5	5			11
Totals.....	237	229	69	492	702	37	26	1792



## AGES OF UNDERGRADUATES.

Class.	No. in Class.	Average age.	Oldest.	Youngest.
Seniors,	36	20 $\frac{1}{2}$	26	18
Juniors,	50	19 $\frac{7}{8}$	21	17
Sophomores,	69	18 $\frac{1}{2}$	21	15
Freshmen,	82	17 $\frac{1}{2}$	22	15

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*Elective and Required Studies.*—The School of Arts or undergraduate department of the College stands midway between the Academy or High School and the University, corresponding pretty closely to the German Gymnasium. As the foundations are here laid for the higher and more widely developed studies of the University, it is considered advantageous in the acquisition of the elementary principles on which the higher education is to rest, that the studies should be limited in number and obligatory, that the student may learn *multum non multa*. In carrying this principle into practice, the studies of the Freshman and Sophomore classes are all obligatory, and those of the Junior class in great part. As the Senior class is composed in part of those who close their academic life with the attainment of the B.A. degree, and in part of those who intend to prosecute their studies still further and to enter upon a professional or university course, a larger selection is allowed and the studies of that year have been made elective. On this as on many other points of college education there are wide differences of opinion. The spirit of Columbia is conservative, and the Faculty, after careful consideration, has advised that for the higher and wider career of the University a system of elective courses judiciously selected in the Senior year, would be more profitable to the student than unrestricted elective studies. For the present, the studies of the Senior year are entirely elective. In the Junior year, Greek, two hours; Latin, two hours; English, three hours; History and Political Economy, two hours; and Logic and Psychology, one hour per week are required studies. Certain studies therefore are elective by both Seniors and Juniors, others by Seniors only. The following has been the election for the current year:

## STUDIES ELECTIVE BY SENIORS ONLY.

Number in Class . . . . .	36
English . . . . .	11
Astronomy . . . . .	21
Philosophy . . . . .	20
Ethics . . . . .	13
Chemistry . . . . .	13
Political Economy . . . . .	23
Constitutional History of Europe . . . . .	7
Constitutional History of England . . . . .	9
Geology . . . . .	6
Anglo-Saxon . . . . .	3
Practical Astronomy . . . . .	1
Icelandic . . . . .	1
Hebrew . . . . .	3

## STUDIES ELECTIVE BY BOTH JUNIORS AND SENIORS.

	Seniors.	Juniors.	Total.
Number in Class . . . . .	36	50	86
Greek . . . . .	6	3*	9
Latin . . . . .	11	8*	19
Mathematics . . . . .	5	10	15
Physics . . . . .	19	29	48
Botany . . . . .	10	18	28
French . . . . .	9	23	32
German . . . . .	11	15	26
Spanish . . . . .	7	8	15

One modern language is required in the Freshman and Sophomore classes ; but each student is at liberty to elect French, German, Italian, or Spanish.

## MODERN LANGUAGES ELECTIVE BY SOPHOMORES AND FRESHMEN.

	Sophomores.	Freshmen.	Total.
Number in Class . . . . .	69	82	151
French . . . . .	32	48	80
German . . . . .	32	24	56
Italian . . . . .	0	1	1
Spanish . . . . .	3	4	7
Specials, electing none . . . . .	2	5	7

\* In the Junior Class Latin and Greek are required for two hours per week each throughout the year ; in addition there is one hour elective in each of these languages.

## TOTAL NUMBER IN ALL THE CLASSES ELECTING MODERN LANGUAGES.

Total number of students	.	.	.	.	.	.	237
Number electing French	.	.	.	.	.	.	112
" " German	.	.	.	.	.	.	82
" " Spanish	.	.	.	.	.	.	22
" " Italian	.	.	.	.	.	.	1

*Lenten Lectures.*—As in previous years application was made by committees from the several classes for permission to invite prominent clergymen to deliver weekly lectures to the students in the College Chapel during the season of Lent. The good effect of the course of the previous year had been shown in the manifest interest and the full and punctual attendance of the great body of the undergraduates. Permission was therefore readily given, and the course this year was opened by the Bishop of the Diocese. In the following weeks brief addresses were made by the Rev. Richard D. Harlan, Rev. H. Y. Satterlee, D.D., Rev. Dr. R. R. Meredith, Rev. Dr. John Hall, Rev. David H. Greer, D.D., and the Rev. Henry A. Adams.

*Free Public Lectures.*—By lectures and addresses in the College buildings, before various literary and scientific associations, the College is becoming a centre of attraction in many directions. Besides these, the Trustees have provided a course of free public lectures in the large room of the Law School every Saturday morning throughout the winter and spring. These lectures have been delivered partly by Professors and Instructors of the College, and partly by volunteers from without, and have proved very attractive: the room has always been well filled, and sometimes has proved insufficient to accommodate comfortably all who sought admission. The course extended from November 17, 1888, to April 27, 1889, and has included a great variety of subjects,—literary, scientific, historical, and philosophical. The difficulty of accommodating all who attend emphasizes our great need—a lecture-hall of sufficient size to accommodate at least five hundred, or better still one thousand. It seems desirable that all public exercises, the Commencements as well as public lectures, given by the authority and

under the sanction of the College government, should be in the buildings of the College.

*Attendance, Scholarship, Discipline.*—The attendance of the students of the undergraduate classes upon lectures and recitations for the part of the year thus far completed has been in the main satisfactory, and not many instances have occurred of absences exceeding the permissible limit. These have usually been caused by sickness, or detention on trains where students reside out of the city. The cases of students asking permission to leave the grounds during college hours have been fewer than in the corresponding period of last year.

There has been a marked improvement in the attendance of the professors and tutors at chapel exercises, and of the instructors in all the departments at the examinations, and especially at the concluding examination.

In previous years the standing of the students of the several classes was indicated by a system of marks, from 5 or 6 as a minimum to 10 as a maximum. The attempt to indicate scholarship by any relations of numbers was often complained of as fallacious, and the Faculty finally abolished the marking system. No substitute denoting grades of scholarship for entire classes was adopted, but at each examination the members of the several classes were reported as proficient or deficient.

Sufficient time has not yet elapsed to determine whether this change will prove a benefit, as the returns for the year are not yet complete.

The conduct of the students in the lecture-rooms and halls has been orderly and becoming, and no act of discipline has been necessary throughout the year.

The details of the courses of study and of the amount accomplished in the several departments are given in the accompanying reports of the heads of departments.

*The School of Mines.*—The attendance of the students and their devotion to the work of the several courses have been satisfactory. As in the previous year, there have been seven parallel courses of instruction, accompanied by work

in the several laboratories; and in addition the regular summer schools of Practical Mining, Surveying, Mechanical Engineering, Practical Geodesy, and Chemistry have been continued. A Summer School of Photography was added as an experiment for the current year, but the attendance on it did not seem to warrant its continuance. The reports of the work accomplished in these summer schools are given in full by the professors conducting them in the Appendix, and the details of the studies of the regular classes will also be appended in the separate reports of the professors.

The following is the distribution in the several courses :

	First Class.	Second Class.	Third Class.	Fourth Class.	Total.
Mining Engineering . . . .	15	6	7	13	41
Civil Engineering . . . .	23	23	15	21	82
Metallurgy . . . . .	1	2	5	0	8
Geology and Palæontology . . .	1	0	0	1	2
Analytical and Applied Chemistry .	17	6	6	6	35
Architecture . . . . .	17	13	18	13	61
					<hr/> 229

*The Law School* seems to retain its place in public estimation, as the numbers for the present year indicate an increase over those for the last, the present attendance being, in the Senior Class, two hundred and forty-eight, and in the Junior Class two hundred and forty-four. The Warden reports that the attendance of the students and their devotion to the studies assigned to them by the statutes have been highly satisfactory. The general condition of the School and the course of study in the several departments will be found detailed in the report of the Warden in the Appendix.

*The School of Political Science.*—The studies of this School are partly combined with those of the Senior Class of the School of Arts, and in part with those of the Law School; students of the School of Arts being allowed, at the close of the Junior year, to enter the first year of the School, and thereby also to become members of the first year of the School of Law. This arrangement enables a student on receiving his degree of B.A. to have completed the first

year of his law course. It also permits a student who has the degree of B.A. from this or other college of equal standing to obtain the degree of M.A. at the end of the *second* year.

The aid afforded by the Academy of Political Science, composed of professors and graduates of the School, and by the *Political Science Quarterly*, under the direction and editorship of its officers will be given in the special report of the Senior Professor in the Appendix.

*School of Medicine.*—The year now passing has been a successful one, although there has been a considerable diminution in the number of students. This seeming loss may be considered a positive gain, for the course of study in the School and the requirements are placed on a higher plane. The changes now made or in contemplation are an examination for admission, a considerable increase of the school year, and the addition of a third year to the course. The consequent introduction of new courses made possible, the greater length of the lecture season, and the modification of the previous curriculum, give promise of a great advance in medical education. The various changes and modifications are given in full in the statement of the Secretary of the Faculty of Medicine appended to this report.

*The Collegiate Course for Women.*—This course, established in 1883, to meet an apparent public demand for the higher and better education of young women, has not in its present form proved successful. The College provided examinations, but required that preparation be made elsewhere. The women students desired instruction rather than examination. Accordingly, after an experience of five years, it has been decided by the Trustees to discontinue the Collegiate Course for Women in its present form, and to approve the establishment of an associate but separate School, under the name of Barnard College, in which the instruction shall or may be given by the professors of the College, under certain regulations and restrictions. This course will therefore be discontinued at the close of the present year, except for those who have already completed a part of the prescribed studies.

*The School of Library Economy.*—In 1884 the Trustees established, in connection with the College, a School in which instruction might be given in the principles of library management, and in which learners might qualify themselves as professional librarians; the School was opened in October, 1886, and placed under the supervision of the Library Committee. The Chief Librarian was appointed director, and instruction was given by him and by some of the library assistants. But this task fell heavily upon those engaged in the ordinary library work and interfered greatly with their regular duties. Experience showed that the continuance of the School required an entire reorganization which should place it in the charge of instructors not engaged in the routine duty of the library. On the resignation of the Chief Librarian at the beginning of the year, the School was placed under the directorship of the Acting President for the remainder of the current year, and an arrangement was made with the Regents of the University, by which the School was transferred to the State library under their charge, on the first of April.

*The Library.*—By the steady addition of valuable works in every department of literature and science under the direction of the Professors, the library is constantly becoming a more useful and necessary factor in College and University work. Through the liberal provision made by the Trustees, numerous and valuable books and sets of books have been added the present year, and still larger additions will be made in the following year. During the ten months to May 1st, by purchase and exchange 5,627 volumes have been added, and by gift, 1,858. In the same period 1,189 pamphlets were given and 312 bought. Among the more important gifts may be mentioned an interesting collection on Mary, Queen of Scots, by Gen. J. W. De Peyster, and a large collection of works on theology, in the Dutch language, by T. F. C. Demarest, Esq. Accommodation has been provided for a greater number of readers by the additional seats and tables in the elevated reading-rooms. The additional shelving ordered this year will pro-

vide for the books now received and awaiting shelf-room. But the larger additions of the coming year will again demand further provision for their accommodation. As the library is opened to the public, who use it liberally, and as in the extension of the hours of recitation and lecture over the day the students will more frequently assemble there to pursue their studies in the intervals, more seats and tables will be required.

The following table shows the number of readers using the library from July, 1888, to May, 1889 :

1888.				1889.			
July	.	.	1,108	January	.	.	5,688
August	.	.	705	February	.	.	7,624
September	.	.	1,195	March	.	.	8,503
October	.	.	7,463	April	.	.	6,695
November	.	.	8,092				
December	.	.	4,400				

At the beginning of the present year, Melvil Dewey, Chief Librarian, resigned his office, and George H. Baker, formerly Assistant Librarian, was elected by the Trustees Librarian of Columbia College.

To give information in regard to new books received in the library, a monthly bulletin of additions made by both purchase and gift is printed.

The list of the additions to the library, the use of books in and drawn from it, and the details of the work done, will be given in full in the report of the Librarian.

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As a Committee of the Trustees has under consideration the elevation and expansion of the whole course of study in the College and University, a simple statement of the operations and condition of the College and its Schools for the past year has been given, without extended suggestions of changes or enlargements.



*Officers of the College—Appointments, Changes, Renewals :*

L. H. Jacoby was appointed Assistant to the Professor of Geodesy and Practical Astronomy, to serve from October 1, 1888.

Mr. Wm. G. Baker and Dr. F. G. Wiechmann appointed examiners for admission to the School of Mines for subjects not taught in the School.

Francis M. Simonds appointed Fellow in Assaying in place of A. L. Beebe, resigned.

The leave of absence granted to Dr. A. V. W. Jackson, Assistant in English, was extended to February 1, 1889, at which time he returned to College and resumed his duties.

Messrs. Thomas Ewing, Jr., W. A. Dunning, Thomas S. Fiske, Edward L. Stabler, Percy F. Hall, D. K. Dodge, and E. A. Wasson, Fellows of the College, whose terms of service expired in July, 1888, were reappointed for another year.

N. E. Crosby was appointed Honorary Fellow in Greek.

Hampton D. Ewing, of the class of 1888, was appointed Prize Fellow in Science.

Clarence H. Young, of the same class, was appointed Prize Fellow in Letters.

The Tutorship in Mathematics in the School of Arts, which had been in abeyance since the autumn of 1884, was revived, and Thomas S. Fiske was appointed to the office for one year from July 1, 1888, his reappointment as Fellow in the same department having been reconsidered, and the appointment not made.

Nelson G. McCrea was appointed Tutorial Fellow in Latin, in place of Mr. Short, whose term of office had expired, to hold office for one year from July 1, 1888.

At the end of September Professor Merriam, who had been absent on leave in Greece, returned to duty.

The following Instructors in the School of Mines, whose terms of service expired July, 1888, were reappointed to hold their respective offices for the term of one year :

Alexis A. Julien, Instructor in Biology and Microscopy.

James L. Greenleaf, Instructor in Engineering and Drawing.

Charles E. Colby, Instructor in Organic Chemistry.

Ferdinand G. Wiechmann, Instructor in Chemical Philosophy and Chemical Physics.

Ira H. Woolson, Assistant in Drawing.

Henry C. Bowen, Fellow, Assistant in Quantitative Analysis.

Herman T. Vulté, Fellow, Assistant in Qualitative Analysis.

Frederick J. H. Merrill, Fellow in Geology.

William H. Stuart, Fellow in Engineering.

John L. Northrup, Fellow in Geology.

Lea McL. Luquer, Fellow in Mineralogy.

Alfred D. F. Hamlin and F. D. Sherman were appointed Instructors in Architecture, to hold office for one year.

Frank D. Dodge was appointed Fellow in Chemistry to assist in the Organic Laboratory, to serve for one year from July 1, 1888.

In the School of Political Science Dr. A. C. Bernheim was appointed Prize Lecturer in place of Dr. Edwin R. A. Selligman.

Mr. John D. Prince was appointed delegate on the expedition to Babylonia, under the auspices of the University of Pennsylvania.

Mr. Charles Sears Baldwin was appointed a Fellow to assist in the Department of English.

Two vacancies in the Mathematical Department occasioned by the resignation of E. L. Stabler, Fellow, and the expiration of the term of service of Maurice G. Gennert, were filled by the appointment of Percy F. Hall and James Maclay, as Fellows for the term of one year.

The appointment of C. B. Laraway as Assistant in Natural History was discontinued from October 1st, and Dr. H. Hensoldt was appointed to the position thus vacated, to hold office for one year.

Philo Perry Safford, a member of the graduating class of the Law School, was appointed Prize Tutor in the place of Robert D. Petty, whose term of office expired in June, 1888. Mr. Petty was subsequently appointed Instructor in the Law School for the current year.

The offer of Mr. Morawetz to deliver lectures before the Senior Class of the Law School upon the law of Private Corporations was accepted.

Dr. Harry Thurston Peck, who had been discharging the duties of the Professor of Latin since Dr. Short's death, was elected Professor of Latin.

James C. Egbert was appointed Tutor in Latin.

B. D. Woodward of the class of 1888, was appointed Prize Fellow in Science in place of G. H. Gilman, resigned.

Professor Benjamin F. Lee was reappointed Professor of Real Estate and Equity Jurisprudence in the School of Law for the current year.

Edward D. Perry, Tutor in Greek and Instructor in Sanskrit, William H. Carpenter, Instructor in the German and Scandinavian Languages, and Guillaume A. Scribner, Instructor in French, were reappointed, the two former to hold office during the pleasure of the Board, the latter for the academic year.

Archibald Alexander, Ph.D., whose health had been failing for some time, resigned at the beginning of 1889 the Professorship of Philosophy, Ethics, and Psychology.

An Adjunct Professorship of Philosophy, Ethics, and Psychology was established, and Nicholas Murray Butler was elected Adjunct Professor.

Melvil Dewey, Chief Librarian, resigned his office at the beginning of this year.

H. D. Ewing, Prize Fellow in Science, was transferred from the Department of Physics to the Department of Mathematics and Astronomy.

Alexander F. Parker, class of 1888, was appointed Assistant in Physics in place of W. W. Share, who resigned his position in February.

Mr. Woodward, assigned temporarily to the Department of Physics.

Prof. George Chase was reappointed Professor of Criminal Law, Torts, and Procedure, to hold office during the pleasure of the Board.

Reginald Gordon was appointed Tutorial Fellow in Physics in place of A. F. Parker, resigned.

F. J. H. Merrill was appointed Fellow in Geology in place of Thomas S. Perkins, resigned.

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This record of the year's changes within the College cannot be closed without special reference to the sad losses it has been called upon to sustain in the death, April 27, 1889, of the venerable and honored President of the institution, Dr. F. A. P. Barnard, full of years and honors; and in that of the distinguished President of the Medical School, Dr. John C. Dalton, who died February 12, 1889.

On the 11th of February, 1889, the Rev. H. I. Schmidt, D.D., was also removed by death, who, although not in the performance of active duty, for his long and useful service in the College had been made Emeritus Professor of the German Language and Literature.

HENRY DRISLER,  
*Acting President.*

SCHOOL OF ARTS.

NUMBER OF STUDENTS FROM 1864 TO 1889.

For the year	1865-6.....	149			
" "	" 1866-7.....	140			
" "	" 1867-8.....	144			
" "	" 1868-9.....	147			
" "	" 1869-70....	129			
" "	" 1870-1.....	120			
" "	" 1871-2.....	117			
" "	" 1872-3.....	123			
" "	" 1873-4.....	127			
" "	" 1874-5.....	151			
" "	" 1875-6 ....	172			
" "	" 1876-7.....	190			
" "	" 1877-8.....	227			
" "	" 1878-9.....	246			
" "	" 1879-80....	278			
" "	" 1880-1.....	285			
" "	" 1881-2.....	295			
" "	" 1882-3.....	281 ;	Graduate		
			students	4.	
" "	" 1883-4.....	264 ;	"	20 ;	Women 6.
" "	" 1884-5.....	257 ;	"	18 ;	" 7
" "	" 1885-6.....	241 ;	"	19 ;	" 13
" "	" 1886-7.....	230 ;	"	22 ;	" 19
" "	" 1887-8.....	228 ;	"	33 ;	" 28
" "	" 1888-9.....	237 ;	"	28 ; +5	" 26.

## SCHOOL OF MINES.

NUMBER OF STUDENTS FROM 1864 TO 1889.

			<i>Regular.</i>	<i>Special.</i>	<i>Total.</i>	<i>Graduate Students.</i>
For the year	1864-5				29	
" "	" 1865-6	54	39	93		
" "	" 1866-7	70	51	121		
" "	" 1867-8	65	60	125		
" "	" 1868-9	71	24	95		
" "	" 1869-70	49	25	74		
" "	" 1870-1	53	44	97		
" "	" 1871-2	56	61	117		
" "	" 1872-3	97	39	136		
" "	" 1873-4	140	25	165		
" "	" 1874-5	182	23	205		
" "	" 1875-6	199	28	227		
" "	" 1876-7	209	20	229		
" "	" 1877-8	231	16	247		
" "	" 1878-9	222	26	248		
" "	" 1879-80	239	40	279		
" "	" 1880-1	246		246		
" "	" 1881-2	271		271		3
" "	" 1882-3	267	1	268		8
" "	" 1883-4	285		285		3
" "	" 1884-5	266		266		5
" "	" 1885-6	238		238		4
" "	" 1886-7	264		264		6
" "	" 1887-8	231		231		8
" "	" 1888-9	229		229		9

## **APPENDICES.**





## APPENDIX A.

### REPORTS ON THE COURSE OF INSTRUCTION IN THE SCHOOL OF ARTS.

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#### DEPARTMENT OF GREEK.

*To Professor H. Drisler, Acting President :*

I have the honor to make the following report of work done in the department of Greek during the past collegiate year :

The instruction of the *Freshman Class* was conducted during eight hours of the week by Mr. M. L. Earle, Fellow of the College. The sixth, seventh, and eighth books of the *Odyssey* were minutely studied during the first session, and the class was repeatedly exercised in the rhythmical reading of Homeric verse and in putting into proper metrical form Homeric verses given in confused order. The sixth book of Herodotus was the subject of the second session, the reading being done with great care at the outset, with attention to the dialectic forms and the style ; afterwards it was made more rapid in order that the whole book might be completed by the close of the session.

Mr. Earle has also conducted, during a portion of the year, a course in Modern Greek for volunteers, and hopes to continue it another year.

Dr. Perry has taken the Freshman Class, in two sections, once a week, throughout the year, giving them a course of Greek syntax and prose composition, using the Hadley-Allen Grammar in part, and in part a series of sentences based on the fifth book of the *Anabasis*.

The work of the *Sophomore Class* has also been under Dr. Perry's charge. The class read the *Medea* of Euripides during the first session, and was exercised in the scanning of iambic and anapaestic verse. At the end of the term about three quarters of the class met Dr. Perry by invitation, two afternoons, for the rapid translation of the entire play. During six weeks of this session the class received instruction in Greek composition, one hour per week, with Boise's Exercises in Greek Syntax as text-book. In the second session the more important parts of books six and seven of Thucydides were read, the selections forming a continuous narrative, and covering about one hundred pages. In April a volunteer class was formed for reading, mainly at sight, Plutarch's Life of Nicias. Five students engaged in this exercise, and have done commendable work. These were Sophomores. Mr. Young, Fellow of the College, has also read nearly the whole year with some volunteers of the Freshman Class, devoting one hour a week to it. Several books of the *Odyssey* were read with much spirit and faithfulness.

During your performance of the duties of Acting President of the College, the instruction of the higher classes has devolved upon me.

The *Junior Class* read the *Ædipus Tyrannus* of Sophocles and the *Protagoras* of Plato in the regular course. The elective section read the *Clouds* of Aristophanes and a number of the *Dialogues* of Lucian.

The Seniors in the elective section of two hours a week read nearly all the *Olympic Odes* of Pindar, and the fourth *Pythian*, during the first session, and the *De Corona* of Demosthenes the second. Another elective section, one hour a week, read the *Orations* of Lysias the first session, and the *Alcestis* and *Medea* of Euripides during the second. A third elective section, one hour per week, read the Acts of the Apostles and the Gospels of St. Luke and St. John. This section was composed partly of Seniors and partly of Graduates.

In the *Graduate Department*, two hours a week were devoted to the *Oresteia*, the *Prometheus*, and the *Persæ* of Æschylus, one hour to Inscriptions.

All the work has been supplemented by lectures upon the subjects treated, and by illustration of persons, scenes, and objects, by means of photographs and the plates of Baumeister's *Denkmaler*, so that the art and the monuments should add their pictorial help to the comprehension of the texts. While abroad last year I gathered photographs on the Continent and in the East especially for this purpose, and they afford a never-failing source to draw from. In the work upon epigraphy, Hicks' Manual was made the basis of work for the student, but was freely illustrated from other sources, especially from a large number of paper impressions of inscriptions made in Athens and the rest of Greece, and in the museums abroad, forming a complete series of typical specimens of Attic orthography from the earliest to the latest times, and examples from most of the other alphabets of Hellas. These are made the means of a minute and accurate study of the monuments, and are in many ways more convenient and helpful than the stones themselves, in their present resting-places. They serve continually to correct the so-called fac-similes, and lead the student to a proper estimate of the characteristics of each period, and the proper means of fixing the date of an inscription, and to note how the changing style of literature and art in the descending centuries finds its reflection in the forms of the letters and general aspect of the inscription.

Yours truly,

A. C. MERRIAM.

Adjunct Professor of Greek.

#### DEPARTMENT OF LATIN.

To the Acting President of Columbia College:

I have the honor to present the following report of the work of the department of Latin for the college year now ending.

(i) *Graduates*. Five graduates have been engaged in advanced study during the year. The work of both terms was based upon the interpretation of two authors, Suetonius and Aulus Gellius. Of the *Lives* of the former, three books were read with careful attention to the language and style, and with reference throughout to the parallel narratives of other historical writers both Greek and Latin, especially to Tacitus, Valerius Maximus, Velleius Paterculus, Plutarch, and Dion Cassius. Of the *Noctes Atticæ* of Gellius, all the chapters relating to questions of etymology, lexicography, and general philology were read,—in all, forty-one chapters. In addition to these, the class read privately the whole of the first and fifth books, which contain forty-seven chapters, and also referred continually to the parallel passages of the *Saturnalia* of Macrobius. The philological questions connected with the text were fully discussed in the light of modern research; and the class also considered and criticised the various readings of the MSS. as well as the conjectural emendations of J. Gronovius, Carrio, and Hertz. Lectures were occasionally given upon subjects relating to the work of the year; and the members of the class were required to prepare and submit for criticism an original commentary on specified portions of the text, with a view to familiarizing themselves with the *apparatus criticus* of a classic author.

(2) *Senior Class.* Nine members of the Senior Class elected a course of two hours per week in Latin. During the first term they read with the undersigned the whole of the *Captivi* of Plautus, paying careful attention to the archaic forms and the Plautine prosody. In the second term, this section read the whole of the second book of Cicero *De Natura Deorum*. Three members of the class elected a third hour of Latin for rapid reading. During the first term, the whole of the *Mostellaria* of Plautus and all of Ramsay's selections from Ovid were read; and during the second term, three books of the epigrams of Martial, including the *Liber Spectaculorum*, in all two hundred and fifty-three epigrams. Six members of the class elected a fourth hour of Latin in the second term, for the study of Roman Antiquities. To this section the undersigned lectured, treating the subject under the following heads: The Age, The City, The Court, The Men, The Women, The Slaves, The Conveniences of Life, Education, Literature, Commerce, Luxury, Morality and Religion. Copious references were continually made to ancient authors, and to the best modern authorities on the subject.

(3) *Junior Class.*—In the two hours per week of Latin required of all members of the Junior Class, there were read during the first term, six Satires of Juvenal,—the First, Third, Fourth, Fifth, Twelfth, and Sixteenth; and during the second term, the whole of the first book of Cicero *De Officiis*. Lectures were given from time to time on Roman Satire, on the Pronunciation of Latin, and on the Philosophy of the New Academy. Ten members of the class elected a third hour of Latin, and read with the undersigned the *Andrian* of Terence and the Second Philippic of Cicero.

(4) *Sophomore Class.*—The Sophomore Class in three sections attended Dr. James C. Egbert, Jr., throughout the year. During the first term one book of the Satires of Horace was read, and during the second term, the whole of the *Agricola* and *Germania* of Tacitus. Much time has been given to a careful study of the peculiarities of the language, to the understanding of the grammatical difficulties, and to the explanation of the historical, philosophical, and archaeological allusions embodied in the text. Lectures were also delivered on the History of the Latin Alphabet, the Roman Historians, and upon the general principles of Latin Etymology.

(5) *Freshman Class.*—This class in four sections has attended Dr. Nelson G. McCrea throughout the year for two hours per week; and Dr. J. C. Egbert, Jr., for an hour per week. With Dr. McCrea, during the first term there were read thirty-nine odes from the third and fourth books of the Odes of Horace. Special attention was called to the connection between the Roman poet and his Greek models, to his position in Latin literature, and to the peculiarities of the Horatian syntax. The poet's metres were also thoroughly examined, and the class committed to memory the ninth, twenty-sixth, and thirtieth odes of the third book. The whole subject of Latin Prosody was likewise thoroughly reviewed. During the second term, the class read the sixty-five letters of Cicero, contained in the edition of Prichard and Bernard. The various epistolary forms were explained and the use of the subjunctive mood was made a special subject of study. Particular attention was given to the political history of the period as illustrated by the letters; and for the clearer understanding of this, Merivale's *Roman Triumvirates* was used as a book of reference. The Life of Atticus, by Cornelius Nepos was, in addition to the above-mentioned, required of the class as a subject for examination. With Dr. Egbert, the class has studied the subject of Latin Prose Composition for one hour per week throughout the year. This work included (a) a thorough review of Latin Syntax accompanied by practical exercises under the direction of the instructor; and (b) the writing of Latin based upon portions of Cicero previously assigned for study, and then taken as a model for imitation. This work was all performed in the class-room under the direction of the instructor, who criticised the exercise in the presence of the class.

(6) *Volunteer Class.*—Twelve members of the Freshman and Sophomore classes have voluntarily attended Mr. Charles Knapp, the Fellow in Latin, for

one hour per week throughout the year, in order to cultivate facility in reading Latin at sight. In this hour there were rapidly read in all thirty letters of Pliny contained in the edition of Prichard and Bernard; and the Lives of Hasdrubal, Hannibal, Cato, Atticus, and Alcibiades, by Cornelius Nepos. The work of this class has been highly satisfactory, and a very marked increase in the numbers of those attending this year as compared with the record of former years, gives evidence that the students themselves feel and properly appreciate the advantage derived from this exercise.

Respectfully submitted,

H. T. PECK,  
*Professor of Latin.*

#### DEPARTMENT OF ENGLISH.

NEW YORK, March 30, 1889.

*Dr. Henry Drisler, Acting President :*

DEAR SIR—For the Department of English Language and Literature, I beg leave to make the following report, up to this date, on the session of 1888-89 :

In the month of October, while I was kept from my work by illness, my duties were discharged without any break by the kind services of Drs. Carpenter, Quackenbos, and Wasson.

The Freshman Class has, during both terms, been twice each week with Dr. Quackenbos and once with me. With Dr. Quackenbos it has studied the elements of rhetoric and composition, and the history of literature, and carried on a course of monthly written exercises. In the correction of these exercises, Dr. Quackenbos has had the effective help of Dr. D. K. Dodge, a Fellow of the College, assistant in English. With me, the Freshman Class has studied the logical analysis and syntax of the language, and has read with minute criticism of style the works of contemporary poets, chiefly Mr. Browning and Mr. Aubrey de Vere, the reading accompanied with lectures on the poets' lives and works.

The Sophomore Class has been, during both terms, twice each week with Dr. Quackenbos, and once with Dr. Carpenter or with Dr. Jackson. With Dr. Quackenbos it has carried on the study of rhetoric and composition, and of the history of literature, and continued the system of monthly written exercises. Here again, in the correction of these exercises, the services of Dr. Dodge have been very valuable. With Dr. Carpenter during the first term, and with Dr. Jackson during the second term, the Sophomore Class has studied the historical grammar of the language, and has read a play of Shakespeare, with minute examination of plot, language, and style.

The Junior Class has been, during both terms, twice each week with me and once either with Dr. Carpenter or with Dr. Jackson. With Drs. Carpenter and Jackson it has studied the elements of Anglo-Saxon and read the Anglo-Saxon prose. With me the class has studied the higher rhetoric, chiefly the formation of sentences and paragraphs, and has read the prose of Bacon's essays, and the poetry of Milton, with minute examination of thought, language, and style. For practice in composition the class has written a systematic course of essays. In the correction of these essays I have had great help from the experience and skill of Dr. E. A. Wasson, Fellow of the College and assistant in English.

The Senior Class has been, with the approval of the trustees, divided into two independent sections, with four hours each week, instead of the former two. Of these sections, the one has come to me twice each week for the study of the historical grammar, and has read copiously with me from the literature of the 11th, 12th, 13th, and 14th centuries down to Chaucer. The other section also has come to me twice a week for the philosophic and æsthetic study of literature; it has pursued a regular course in the study of prose composition, and another course in the study of poetry and poetical form. In the essay work of this

class also, I have had the help of Dr. E. A. Wasson. The change in the organization of the Senior Class in English, and the increase of hours, have had the happiest results.

A class of two (2) young men, both graduates and Fellows of the College, have carried on with me a regular course of graduate studies, coming to me twice each week. The course for this year has been the reading of the poetic literature from the 10th to the 14th century, and the study of the historical development of the poetic art in English. They have worked with much spirit and faithfulness, and they have made much progress.

In forming and conducting the courses for women and in holding examinations, I have had the faithful help of Mr. Charles S. Baldwin, a Fellow of the College and assistant in English.

Respectfully submitted,  
THOMAS R. PRICE,  
*Professor of English Language and Literature.*

DEPARTMENT OF MATHEMATICS, MECHANICS, AND  
ASTRONOMY.

To H. Drisler, LL.D., Acting President of Columbia College :

I have the honor to report that this department is charged with the duty of giving instruction in *Astronomy*, *Calculus*, *Analytical Geometry*, and *Elementary Mechanics*, in the Undergraduate Department of Arts, and in *Determinants*, *Modern Co-ordinate Geometry*, and *Higher Mechanics* in the Graduate Department. It is also charged with the duty of teaching *Analytical* and *Elementary Mechanics* in the School of Mines.

The subjects taught in the School of Arts are all elective. Of the 35 students of the Senior Class more than 62 per cent. have elected *Astronomy*, and over 14 per cent. have chosen *Calculus*. Of the 49 students of the Junior Class, more than 22 per cent. have elected *Analytical Geometry* and *Mechanics*. These data indicate that the relative number of students who choose mathematical subjects is about the same as in former years.

SENIOR CLASS.

1° ASTRONOMY.—Instruction in this branch has been by lecture, illustrated by numerous lantern illustrations. The progress of the students, as tested by frequent examinations, has been all that could be desired. Time, two hours per week throughout the year.

2° CALCULUS.—This subject has been taught, as heretofore, by recitation and drill, using a text-book prepared for the purpose. The students in this branch have made good progress, having gone over the entire ground traversed by preceding classes.

JUNIOR CLASS.

1° ANALYTICAL GEOMETRY.—This branch has been taught, as in previous years, by the aid of a text-book. The students in this branch have shown great zeal, and have accomplished a considerably larger amount of work than is usual. Time, three hours per week during the first term.

2° ELEMENTARY MECHANICS.—The time allotted to this branch is three hours per week through the second term. Of these, two hours per week have been devoted to the study of a text-book, and one hour per week to a course of lectures illustrated by experiment and the exhibition of models. As heretofore, great assistance has been derived from the *Willis' Apparatus* and the *Schroeder Models*.

Eighteen students in Architecture of the third class of the School of Mines have attended the lectures delivered to the college class of *Mechanics*.

## GRADUATE DEPARTMENT.

The course of *Graduate Instruction* is intended to cover two years: during the *first* year the students are instructed in *Determinants* and *Modern Co-ordinate Geometry*, and during the *second* year in *Higher Mechanics*.

*Five* students were enrolled in the first of these classes, but only *three* have attended throughout the entire year. Of these, *two* have also attended the second-year course continuously through the academic year.

The time allotted to Graduate work is entirely inadequate to its importance as a factor in the coming university development of our college.

Your attention is respectfully called to the question of an extension of the number of hours now given to Graduate work, as well as to the importance of a more efficient organization of the Mathematical Department of Graduate instruction.

## ASSISTANCE.

I regret to say that Mr. Lincoln Cromwell, a prize fellow of 1886, who has rendered me most valuable assistance for three years, will retire from the Department at the end of the current year. During the time he has been with me he has been devoted to the interests of this College, and I feel that he is entitled to very much of the credit for the present efficiency of the experimental and illustrative work of the Department.

Very respectfully,

WM. G. PECK,

*Professor of Mathematics, Mechanics, and Astronomy, Columbia College.*

## DEPARTMENT OF MATHEMATICS.

*Professor H. Drisler, LL.D., Acting President of Columbia College.*

I have the honor to report that, during the past year, the freshman and sophomore classes have regularly attended in mathematics at the times prescribed in the official scheme of attendance, and have accomplished the course of study set forth in the Handbook of Information.

Adjunct Professor Goodwin has had, for two hours per week during the second term, a volunteer class for the study of graphic algebra. The exercises are held in the afternoon, at hours not interfering with any prescribed work, have been well attended, and have accomplished much good.

The examinations for mathematical honors will be held at the same time as the ordinary pass examinations, and will, for each of the classes, be upon the entire work of the year. Candidates for the prize scholarships will be held to the honor examinations, and, further, will be examined upon certain additional topics given to them at the beginning of the year.

In graduate mathematics there have been, during the year, two classes, each consisting of two graduates. One class has been given a course in quaternions, based upon but not limited to Hardy's Quaternions; the other has had an extended course in higher differential and integral calculus. Occasional lectures, upon subjects assigned in connection with their studies, have been given by members of the graduate classes, and have proved of much interest and profit. These classes have been conducted, under my immediate supervision, by Dr. Thomas S. Fiske, Tutor in Mathematics, and it gives me great pleasure to say that Dr. Fiske has more than justified the high opinion I expressed of him when I asked for his appointment a year ago.

Respectfully submitted,

J. H. VAN AMRINGE,

*Professor of Mathematics.*

Columbia College, School of Arts, March 30, 1889.

## DEPARTMENT OF GEODESY AND PRACTICAL ASTRONOMY.

To the Acting President of Columbia College :

I have the honor to report as follows :

(1) *The post-graduate class* (one student) in practical astronomy attended one hour a week, besides doing considerable work in the Observatory. The special subjects of (a) latitude by Talcott's method, and (b) precession, nutation, aberration, and proper motion have absorbed most of the time.

(2) *The post-graduate class* in "the method of least squares" has read Merriam on *Least Squares*, and has worked out some practical examples. The class numbers one student.

(3) *The Senior Class* in "practical astronomy" (one student) has attended two hours a week, besides spending considerable time in sextant and transit observations and reductions. This course is elective for those with the proper training.

(4) *The Senior Class* in "navigation," which is optional for those having the mathematical ability required, numbered four at the beginning of the term. Two have dropped out for special reasons. The class is taught by lectures and text-books the theory and use of the sextant in time latitude and longitude observations and reductions; also the theory and use of the transit instrument, etc. The class attends two hours a week, and is required to make and reduce their own observations.

(5) *The Observatory*, under the care of my assistant, L. Harold Jacoby, A.M., has been open to students every day and on nearly every clear night since October 1, 1888.

I append my assistant's report.

Respectfully submitted,

JOHN KROM REES,

*Professor of Geodesy and Practical Astronomy.*

Columbia College, April 4, 1889.

To Professor J. K. Rees :

The work that you have assigned to me as your assistant has required my presence at the College every day and clear evening, including Saturdays. I have accordingly been at the College every day between the hours of nine and four, and, with few exceptions, every clear evening has been given to Observatory work. Up to this time all the students pursuing the courses of Astronomy under Professors Peck and Rees have been instructed by me in various matters relating to the work of Practical Astronomy.

Since October 1, 1888, about 120 visitors have been afforded an opportunity of seeing our apparatus and viewing the heavens.

Respectfully submitted,

L. H. JACOBY.

*Assistant in Geodesy and Practical Astronomy.*

## DEPARTMENT OF CHEMISTRY.

To the Acting President of Columbia College :

I have the honor to report that in the Academic Department of the College I have met the Sophomore Class once a week during the past year, and have given instruction on the non-metallic elements and their compounds, including the chemistry of the atmosphere and composition of water. I find the amount of time allotted to me for this purpose entirely inadequate. Between the hours taken for examination and the hours lost by holidays and vacations, I have, on the whole, a very small number of lectures. As it has always been the intention to have the sophomore students well prepared for admission to the School

of Mines, it seems desirable that they should be well grounded in the chemistry of the non-metallic elements, and I would respectfully suggest that an allotment of two hours a week would enable me to much more than double the usefulness of this course of instruction. Although the class has been very attentive and regular, it is still difficult to keep up the interest when the exercises come only once a week.

The portion of the Senior Class (thirteen members) which elected chemistry has attended two lectures a week. The subjects studied were the chemistry of the metals and organic chemistry. In addition to the lectures the members of the class have had a weekly recitation, which was held by F. G. Wiechmann, Ph.D., Instructor in Chemical Physics and Chemical Philosophy. The progress made by the class has been entirely satisfactory.

Respectfully submitted,

C. F. CHANDLER,  
*Professor of Chemistry.*

Columbia College, May 2, 1889.

#### DEPARTMENT OF PHYSICS.

The Senior Class was engaged three hours per week during the first and second terms, the subjects being : first term, Electricity ; second term, Optics.

*Electricity.*—Properties of magnets ; magnetic induction ; difference between magnets and magnetic substances ; magnetic attractions and repulsions ; terrestrial magnetism ; frictional electricity ; electrical attractions and repulsions ; electrical capacity ; electrical potential ; electrical induction ; electrical machines and batteries ; voltaic batteries ; polarization ; galvanometer ; tangent compass ; Ohm's law ; luminous, heating, and chemical effects of batteries ; electro-metallurgy ; attraction and repulsion of currents ; electro-magnets, electric telegraphs ; electro-motors ; voltaic induction ; magneto-induction ; inductorium ; magneto-electrical machines ; telephone ; microphone ; phonograph ; thermo-electric currents.

*Optics.*—Velocity of light ; photometers ; reflection ; plane, concave, and convex mirrors ; spherical aberration ; index of refraction ; prisms, lenses ; spherical and chromatic aberration ; spectroscopy ; lines from the sun and stars ; phosphorescence ; fluorescence ; optical instruments ; simple and compound microscopes ; photographic camera ; astronomical and terrestrial telescopes ; human eye ; ophthalmoscope.

A portion of the Senior Class attended two hours per week during both terms a course in Higher Physics, the subjects being as follows :

*First term.*—First law of mechanical theory of heat ; experiments of Joule, Rowland, and Hirn ; indicator diagrams ; isothermals of gases, liquids, and solids ; adiabatic curves ; isothermals of steam ; Carnot's engine ; second law of mechanical theory of heat ; steam-engines and caloric engines ; specific heat of solids, liquids, and gases ; kinetic theory of gases ; physiological applications of theory of heat.

*Electricity.*—Electrical units ; constants of a battery ; Wheatstone bridge ; resistance ; electro-motive force ; potential ; dynamos ; thermo-dynamics of a battery ; theory of dynamos and electric motors.

*Undulatory theory of light.*—Reflection and refraction ; interference of light waves ; measurement of length of waves, double refraction ; plane circular, and elliptical polarization ; conical refraction.

The Junior Class was engaged for two hours per week for two terms, subject being, first term, Sound ; second term, Heat.

*Sound.*—Nature of sound waves ; velocity of sound in solids, liquids, and gases ; reflection and refraction of sound ; noise and musical tones ; measurement of length of sound waves ; interference ; laws of vibrating strings ; musical scale ; vibrations of rods ; flute pipes ; reed pipes ; vibrations of plates ; resonance ; clang-tint ; the voice ; the ear.



*Heat*.—Coefficients of expansion of solids, liquids, and gases; compensated pendulum; thermometers; fusion: latent heat; solution; tension of vapors; liquefaction of vapors; hygrometry; conduction by solids, liquids, and gases; specific heat; radiant heat; steam-engine.

Very respectfully,

OGDEN N. ROOD,  
*Professor of Physics in Columbia College.*

New York, April, 1889.

#### DEPARTMENT OF HISTORY AND POLITICAL SCIENCE.

*To the Acting President of Columbia College:*

In the department of History in the School of Arts, the Sophomore Class has been taught, two hours per week, in three divisions, by Dr. Dunning and Mr. Goodnow, in the elements of universal history. The class has been occupied during the entire year in this study.

The Junior Class has been taught a continuation of the same study, two hours per week, during the first term, by Adj. Prof. Munroe Smith.

The Senior Class has been taught, two hours per week, during the entire year, in the Constitutional History of England, by Prof. R. M. Smith, and four hours per week during the entire year in the Constitutional History of Continental Europe and of the United States, by the head of the department.

Respectfully submitted,

JOHN W. BURGESS,  
*Professor of History and Political Science.*

Columbia College, April 26, 1889.

#### DEPARTMENT OF POLITICAL ECONOMY AND SOCIAL SCIENCE.

*To the Acting President of Columbia College:*

In the department of Political Economy and Social Science I have the honor to report that the following work has been done:

In the School of Arts, the Junior Class has been instructed in the principles of Political Economy, two hours per week during the second term, using Walker's Political Economy as a text-book.

The Senior Class (an elective division) has listened to lectures four hours per week throughout the year on Historical and Practical Political Economy.

Respectfully submitted,

RICHMOND M. SMITH,  
*Professor of Political Economy and Social Science.*

Columbia College, May 1, 1889.

#### DEPARTMENT OF PHILOSOPHY.

*To the Acting President of Columbia College:*

During the present academic year the work of the department has been successfully prosecuted with no interruptions save those in the earlier part of the year caused by the continued ill-health of Prof. Alexander, the late head of this department.

The Junior Class has received instruction in Logic throughout the year from Dr. Dunning. The class has been divided into two sections, each meeting the instructor once weekly, and the ground covered includes elementary deductive logic, together with many practical exercises, and an outline of induction and its methods. Psychology has not been taught to this class, as prescribed in the curriculum, nor can it be so long as the present very meagre allotment of time is continued.

To the Senior Class three elective courses have been offered, and though difficult courses they have attracted a gratifying number of students. Of thirty-five matriculated members of the Senior Class, twenty-one have elected Psychology, fourteen the History of Philosophy, and sixteen Ethics. In Psychology, Murray's "Hand-book of Psychology" has been used as the principal book of reference, and a course of lectures has been delivered in which mental phenomena have been analyzed and discussed, and the processes of knowledge carefully traced, due regard being had to the physiological concomitants of mental action. In the History of Philosophy a course of lectures has been delivered, discussing the development of philosophical thought from the early Greek schools to our own time. In Ethics, the instruction has also been wholly by lecture, and has embraced an analysis of moral phenomena and an examination of the content and validity of the fundamental moral notions.

The Graduate Courses have been three in number, one in Ethics, one on the Philosophy of Kant, and the Philosophical Seminar. Eight graduate students altogether have been in attendance. For various reasons several of these were compelled to abandon regular attendance on the lectures about the middle of the year. In the Seminar the subject of study has been "The Philosophy of Hermann Lotze," and his *Microcosmus* has been carefully read and discussed. Papers have also been presented by members of the Seminar, as follows :

Mr. Dows—Lotze's Life and Education ; Scientific Theories of Creation ; The Criteria of Truth.

Mr. Wellwood—Boscovich's Theory of Motion ; Hegel's Philosophy of History.

Mr. Lorenz—Lotze's Theory of Local Signs.

Mr. Carhart—Lotze's Influence on American Thought ; Theories as to the Origin of Language ; What Constitutes Science ?

Mr. Illman—Theories as to the Origin of Life ; Relation of Man to the Lower Animals ; The Place of Æsthetics in Philosophy.

Mr. Hall—Lotze's Treatment of Mechanical Theory ; What is Conscience ?

Mr. Harris—The Relations of Mind and Body ; The Environment.

I must repeat my recommendation of last year to the effect that the establishment of graduate scholarships or fellowships is extremely desirable in order to develop properly the advanced work in Philosophy.

Respectfully submitted,

NICHOLAS MURRAY BUTLER,

*Adjunct Professor of Philosophy, Ethics, and Psychology.*

Columbia College, April 2, 1889.

#### REPORT ON INSTRUCTION IN SANSKRIT.

To Henry Drisler, LL.D., Acting President :

SIR : I have the honor to make the following report upon the instruction in Sanskrit which I have given during the College year, 1888-9 :

##### A. Advanced Class.

With one graduate, Mr. Knapp, who had already gone through a two years' course, I have pursued a course of advanced Sanskrit, of two hours weekly during the first term, and three hours weekly during the second term. In the first term the text-book used was Windisch's *Zwölf Hymnen des Rigveda mit dem Commentar des Sâyana* ; in the second term we have read together the drama *Çakuntalâ*.

##### B. Beginner's Class.

Another graduate, Mr. Woodward, has pursued an elementary course in Sanskrit throughout the year, of three and two hours per week during the first and second terms respectively. Mr. Woodward was able to give but a limited amount of time to Sanskrit, his time being occupied with other subjects ; but

his progress has been very satisfactory under the circumstances. He has finished my *Sanskrit Primer*, and read some selections from Lanman's *Sanskrit Reader*.

All of which is respectfully submitted,

E. D. PERRY,  
*Instructor in Sanskrit.*

Columbia College, May 6, 1889.

#### DEPARTMENT OF SEMITIC LANGUAGES.

*To Professor Henry Drisler, Acting President of Columbia College :*

DEAR SIR :—I have the honor to make the following report regarding the work done during the past year in the department of Semitic Oriental languages :

##### *Hebrew :*

*a.* In elementary work five students attended me during the first term, and four during the second, for two hours per week. Thirty-five lessons in Harper's "Introductory Hebrew Method and Manual," in connection with Harper's "Elements of Hebrew," were carefully studied. Written translations from English into Hebrew were required every week.

*b.* In more advanced work three students attended me for two hours a week. They studied lessons twenty-five to fifty in Harper's "Method," as well as selections from the Book of Psalms. Written exercises were required as before.

*c.* In Biblical Hebrew two students attended me for two hours a week. Isaiah 40-50 was studied critically, together with §§ 38-96 in Gesenius' Hebrew Grammar (last edition).

*Post-Biblical Hebrew.* The following courses were given :

*a.* Mekhilta or Rabbinical Exposition of Exodus, one hour a week. Three students read with me twenty-three pages (ed. Vienna, 1870).

*b.* Mishnah, with Tosephtah, two hours a week. Two students read the treatise Yômā (Day of Atonement).

*c.* David Kimhi's Exposition of the Psalms (ed. Schiller), one hour a week ; two students read thirty pages.

*d.* The Poetry of Yehudhah Hallevy, one hour a week during the first term ; one student.

*e.* The philosophical work (Beliefs and Dogmas) of Saadyah Gāôn, two hours a week. Two students read seventy-five pages (ed. Leipzig, 1859).

##### *Assyrian :*

During the second term two students commenced a course in Assyrian with me, two hours per week. The rudiments of the grammar were carefully gone over, and the following texts read and explained in the original cuneiform : The account of the Egyptian campaign of Assurbanipal (90 lines in Lyon's Assyrian Manual). The account of the same king's capture of Susa (105 lines in Delitzsch's Assyrische Lesestücke), and the account of the expedition of Tiglath Pileser to the land of Na'ri (89 lines in Delitzsch's Assyrische Lesestücke). Translations of English into Assyrian were required at every lesson.

In advanced Assyrian one student read, during two hours a week, the whole cuneiform account of the Deluge (295 lines in Delitzsch's Assyrische Lesestücke), with constant reference to Delitzsch's Assyrische Grammatik.

In both classes collateral reading was required of the students. In this way the following books were studied : Babelon, Manual of Oriental Archeology ; Kanlen, Assyrien und Babylonien ; Budge, Babylonian Life and History ; Menant, Les langues perdues de la Perse et de l'Assyrie ; Sayce, Assyria ; and Hommel, Geschichte Babylonien und Assyrien.

##### *Arabic :*

In advanced Arabic one student attended me during the second term for two hours a week. The etymology in Caspari's Grammar was carefully re-

viewed, and twenty-one Suras of the Qur'ān read in chronological order with constant reference to the Commentary of Beidhāwī and the Works of Nöldeke, Muir, Sprenger, Geiger, and Müller. Muir's Life of Mohammed was required as private reading.

*Syriac :*

In elementary Syriac one student attended me for two hours a week during the second term. Nestle's Syriac Grammar was carefully studied in conjunction with reading from the Chrestomathy attached to the Grammar.

*Semitic Epigraphy :*

One student took the course for two hours a week during the second term. The origin and development of the Semitic alphabet was studied, and the original Phœnician texts of the inscriptions of Gebal, Um el Awāmid, Sidon, Tyre, and Cyprus, as well as the Siloam and Mēsha inscriptions, were carefully read.

Respectfully submitted,

RICHARD GOTTHEIL,

*Professor of Rabbinical Hebrew and Lecturer on Syriac.*

Columbia College. May 10, 1889.

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DEPARTMENT OF MODERN LANGUAGES.

*To Professor Drisler, Acting President of Columbia College :*

DEAR SIR :—I have the honor to submit the accompanying report of the work performed during the current year in the department of Modern Languages. Under existing conditions we are unable to accomplish results satisfactory to ourselves and equivalent to those obtained in our foremost sister institutions. I would, with all due respect, affirm that, without any requirements in Modern Languages at the entrance examination and with courses limited to two hours a week and to some thirty weeks in the year, it is not possible for us to lead our students, by the end of Junior year, to that degree of proficiency which every college man of ordinary abilities should have obtained in order rightly to profit from the courses of Senior year. Sooner or later some change must be made which shall enlarge our capacities for instruction, either by relegating primary discipline in French and German to the preparatory schools, or by augmenting the number of hours assigned during the first two years to the study of these branches.

The detailed report of the work as submitted to me by the instructors in charge of the various sections will be found below. As regards my own instructorial work, I have had the following classes :

1st. German, third year, four hours a week, two required, two optional. Ten students. Read in class-room some 500 pages of German, including the whole of Scheffel's Ekkehardt. Outside reading, 500 pages required, but this requirement will not be strictly enforced this year. German conversation.

2d. Optional fourth year German, one hour a week. Four students. Goethe's Egmont, Iphigénie, Torquato Tasso, Götz von Berlichingen, Reineke Fuchs, Hermann und Dorothea ; also his elegies and selections from other works. In this class there was no translation, only explanation of difficult passages.

3d. Lectures on Romance Literature. This course is intended as complementary to the courses delivered by Mr. Scribner upon French literature, and has been introduced for the first time this year. If it attracts a sufficient number of students, it will be extended so as to embrace all of Romance literature outside of French. Course this year, illustrated by printed schemes (in Spanish and Provençal), has been confined to Spanish and Italian literature. Lectures, three per week, have been accompanied with reading of selections from all the more important monuments. (Two students ; one a graduate.)

4th. Icelandic advanced, three hours a week, one student (graduate). Read Landnama Saga, Njáls Saga ; also selections from Islenzkar Thjòthsögur (Arnason), etc. Considerable attention has been paid to Icelandic conversation and to translation from English into Icelandic. The last recitations of the year will be especially devoted to phonetics.

## GERMANIC DIVISION.

## A. GERMAN LANGUAGE AND LITERATURE (GEBHARD CHAIR).

*To the Acting President of Columbia College :*

I have the honor to submit the following report of the work done in the department of German during the academic year 1888-1889.

The first year's class has been under the charge of Dr. W. H. Carpenter and has been attended by forty-two students divided into two sections, each of which has had two hours' instruction weekly. The text-books used have been Whitney's Brief German Grammar, which has been completed, and Otis' edition of Grimm's Märchen, of which thirty pages have been read. The class has also had frequent exercises in translation from English into German.

The second year's class, which has been under my charge, has numbered thirty-two students, divided into sections. The first term was devoted to the study of three acts of Schiller's "Wilhelm Tell," and during the second term we have been reading about sixty-five pages of Buchheim's Heine's Prosa. Beside the two hours weekly for each section, included in the regular course, I have offered two additional hours in German conversation. Twenty-eight students have availed themselves of this exercise, and hence, I am encouraged to believe, found it very profitable. Nothing but German has been spoken in the classroom during these voluntary hours. Dr. Carpenter has given one hour's instruction, weekly, to one section of the regular second year's class.

The fourth year's work, which has been under my charge, has included the study of Goethe's "Faust" (first part entire and lectures on the second part, with translations of the principal scenes upon which the action hinges), and a course of lectures on German literature from earliest historic period down to the present time. To each of these studies two hours a week have been devoted. The number of students in the "Faust" class was sixteen during the first term and fifteen during the second. The lectures on German literature have been attended by seven students.

One student has pursued the study of the Danish language and literature under my instruction; and five women have presented themselves for examination in the second and fourth year's German.

Respectfully submitted,

HJALMAR H. BOYESEN.

Columbia College, April 8, 1889.

## B. GERMANIC PHILOLOGY AND SCANDINAVIAN LANGUAGES.

In *Icelandic* one hour weekly has been given, throughout the year, to one member of the Senior Class.

*Graduate work :*

In *Icelandic* (phonetics) one hour weekly has been given to one student, Mr. Woodward.

In *Middle High German* one hour weekly has been given to one student, Mr. Woodward.

In *Old Saxon* (phonetics) one hour weekly has been given to two students, Mr. Baldwin and Mr. Woodward.

In *Old Saxon* (language and literature) one hour weekly has been given in second term to one student, Mr. Baldwin.

Respectfully submitted,

WM. H. CARPENTER,

*Instructor in German and the Scandinavian Languages.*

## ROMANCE DIVISION.

## A. FRENCH AND ROMANCE PHILOLOGY.

First-Year French, two hours a week. Fourteen students. Read Chardenal's First French Course, O'Connor's *Choix de Contes*, *Le Siège de Berlin*, *L'Enfant Espion*, *Les Vices du Capitaine*, *L'Oncle et le Neveu*.

Second-Year French, four hours a week (two sections). Thirty-eight students. Read Chardenal's Second French Course, L. Halévy's *L'Abbé Constantin*, About's *La Mère de la Marquise*.

Third-Year, two hours a week. Twenty-two students. Read Modern Plays—*Le Gendre de M. Poirier*, *Le testament de César Girodot*. Classical Plays—*Le Cid*, *Le Misanthrope*. Outside reading, 600 pages; twelve essays in French on works read.

Graduate, two hours a week. One student. Lectures on phonology of French proper and dialects of France and Italy. Provençal—extracts from Bartsch's *Chrestomathie*, Original investigations on comparative verb formation in Romance languages.

Respectfully submitted,

B. F. O'CONNOR,  
*Instructor in French and Romance Philology.*

## B. FRENCH LANGUAGE AND LITERATURE.

First-Year French, two hours a week. Twenty-seven students. Work done: Chardenal's First French Course, O'Connor's *Choix de Contes Contemporains*, *Le Siège de Berlin*, *Les Vices du Capitaine*, *L'Oncle et le Neveu*, *L'Album du Régiment* (likely not the whole of last tale).

*Special Course*, two hours a week. Thirty-seven students. Study of the Literature of the Nineteenth Century, Lectures, Monthly Essays on the works of the principal writers of the period. Outside Reading, about 600 pages.

*Third-Year Literature*, two hours a week. Eight students. Two Lectures a week on French Literature from its origin to the end of the Seventeenth Century.

*Fourth-Year Literature*, two hours a week. Seven students. Two Lectures a week on French Literature from the Eighteenth Century to our own days.

*Fourth-Year Classical Course*. Five students. Composition, Idiomatic Construction, Translations from Scott, Addison, Dickens; Dictation, Essays in French on Hugo and the Romantic School. Outside Reading, 500 pages.

Optional Course. A course of weekly lectures on France and its institutions. Conversation on the topics dealt upon in the Lectures.

Respectfully submitted,

G. A. SRIENER,  
*Instructor in French.*

## C. ITALIAN AND SPANISH.

Spanish, First year. Read one hundred pages in Mantilla's *Libro de Lectura*, No. 3; one book of *Gil Blas*; also studied Sales' *Spanish Grammar* (entire), with reference to the *Grammar of the Spanish Academy*, and to Knapp's and Wigger's *Grammars*. For Conversation we have used Franz Thimm's "*Spanish Self-Taught*."

Second year. Read fifty to seventy pages of *Don Quijote*, and Calderon's "*La Vida es Sueño*." A course of lectures has been delivered in Spanish on the *Life and Works of Cervantes*. Spanish conversation.

In the third year we have spent one half of the time in the writing of from forty to fifty commercial letters in the Spanish language, besides translating some fifty pages into Spanish from the works of Washington Irving, Cooper, Dickens, etc. The students have also prepared original compositions in Spanish. One hour a week was devoted to conversation, with most gratifying results.

*Italian.*

First year: Montague's Italian Literature, and Sauer's Italian Grammar, including Syntax, with references to Vockerardt's Italienische Grammatik, and to Gaspar's Geschichte der Italienischen Literatur. Read five cantos in Ariosto's Orlando Furioso, with references to Rajna's Le Fonti dell' Orlando Furioso. We have also studied Franz Thimm's "Italian Self-Taught," and spent much time in conversation; also delivered lectures on Italian versification.

Respectfully submitted,

BERTRAND CLOVER,

*Instructor in Italian and Spanish.*

The foregoing reports are respectfully submitted.

CHARLES SPRAGUE SMITH,

*Professor of Modern Languages and Foreign Literature.*

April 22, 1889.

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For Report on GEOLOGY and BOTANY see reports of Professor Newberry and Dr. Britton in APPENDIX B, School of Mines.

## APPENDIX B.

### SCHOOL OF MINES.

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#### DEPARTMENT OF MINERALOGY AND METALLURGY.

*Dr. Drisler, Acting President of Columbia College :*

DEAR SIR—I beg to report that in the Department of Mineralogy the work has progressed as usual during the year, the ordinary number of lectures and conferences having been given, but on a somewhat different plan from that heretofore pursued, and the studies of the year have been very successfully prosecuted. The work has been as usual very confining. A very large number of specimens have been added to the collection. Its usefulness has been further increased by the Catalogue of Minerals and Synonyms upon which we have been engaged for five or six years, which has been published by the United States Museum, and makes it possible for not only this but every other museum in the country to catalogue their minerals and refer to them with the greatest possible ease. It is really an addition to the science of mineralogy, as it covers the ground of synonyms. There have been added to the collection since April, 1888, 776 specimens, worth about \$1,500. Very many of these I collected myself in my trip through the West last summer, others were purchased, others have been procured by exchange with museums at home and abroad, and some of them which I did not feel at liberty to buy with the funds at my disposition, have been presented to the collection, making very valuable additions to it. It is a very gratifying thing that I have been able to find persons in the city who are sufficiently interested in science to make these donations. A system of reference to mineralogical researches has been undertaken by collecting the original researches of different investigators and arranging them in such a way with a card catalogue that they can be consulted. I have deposited in this collection all my own pamphlets, and have secured a very large number of others, and this with the Catalogue of Minerals and Synonyms will very soon, I hope, cause the collection to be consulted from all parts of the country.

The work of instructing the students I have been turning more and more every year into something like field work, which it is quite possible for me to do now that the appropriations are sufficient to make the three different kinds of collections in addition to the main collection which are necessary to give this kind of instruction. I think most of the students take a real pleasure in their work. Most of them are enthusiastic in their studies.

Little has been done with the metallurgical collection, on account of the altogether inadequate space which it occupies, but some valuable additions have been made to it. Various investigations have been prosecuted during the year, which promise very interesting results, growing out of the investigations made at the mills and mines during my last summer's trip. These will be shortly published.

A system of conferences similar to those in mineralogy is greatly needed, and I hope before long to institute them when we shall have sufficient room for the instruction. As it is now, both of the departments are so crowded that it has



been necessary to use the laboratory as a conference room for the students. In fact, they are scattered all through the rooms which should be maintained solely and exclusively for the use of the four instructors, and for the preparation of lectures, greatly to our inconvenience. I had hoped that the building on 49th Street would have been built during the course of the last year, and that the work of instruction could have been concentrated in such a way as to be most effective. This, however, has not been realized.

I hope in the course of the next year to report a plan for a considerable improvement in the direction of practical instruction in Metallurgy at the School. This, however, depends upon my being able to raise a considerable amount of money for the putting up of a laboratory where the students can actually handle the tools exactly as they would in large works. It is impossible to say whether this scheme can be realized until an actual trial has been made to see whether the public can be induced to take an interest in such matters. I am encouraged to consider the plan, however, from the universal expression of interest in it and wish that it might be realized which met me every time that I spoke of it during my last trip through the mining regions. If it can be realized, it will add very materially to the usefulness of the Department.

Yours respectfully,

THOS. EGLESTON.

Columbia College, May 7, 1889.

#### DEPARTMENT OF CHEMISTRY.

##### *To the Acting President of Columbia College :*

I have the honor to report that in the Chemical Department of the School of Mines during the first term of the past year I met all the First-Year students twice a week and lectured upon the metals. H. T. Vulté, Ph.D., Assistant Instructor in Qualitative Analysis, has held recitations upon the lectures, the class being divided into four sections for this purpose, each section reciting once a week. During the second term I have met the First-Year students, in the course of Analytical and Applied Chemistry, twice a week, lecturing upon Organic Chemistry ; and Dr. Vulté has held recitations upon the lectures twice a week, the class being divided into two sections. In addition to this the First-Year students in the course of Analytical and Applied Chemistry received instruction in Chemical Physics twice a week, during the second term, from F. G. Wiechmann, Ph.D., Instructor in Chemical Physics and Chemical Philosophy.

I met the Second-Year students in all the courses twice a week during the entire year, and lectured upon Applied Chemistry. The class was divided into four sections, and each section attended recitations once a week under the direction of L. H. Laudy, Ph.D., Assistant in General Chemistry. The Second-Year students, in the course of Analytical and Applied Chemistry, have also attended four recitations a week throughout the year on the subject of Chemical Philosophy under the instruction of Dr. Wiechmann.

The Third- and Fourth-Year students, in the course of Analytical and Applied Chemistry, have attended my lectures on Applied Chemistry three times a week during the entire year, and recitations have been held upon the subjects of the lectures by C. E. Pellew, E.M., Honorary Fellow in Applied Chemistry.

In Qualitative Analysis J. S. C. Wells, Ph.D., has given to the First-Year students two lectures a week, and Dr. Vulté has held recitations twice a week upon the subject, the class being divided into two sections.

In Quantitative Analysis Professor Waller has lectured to portions of the Second, Third, and Fourth classes, and H. C. Bowen has held recitations upon the subject of the lectures : to the students of the Second Year, in the course of Analytical and Applied Chemistry, two lectures and two recitations a week ; to the students of the Third Year, in the course of Analytical and Applied

Chemistry, two lectures and two recitations a week, during the first session ; and to the Fourth-Year students, in the course of Mining Engineering, one lecture a week during the second session. Also to the students of the Second and Third Years, in the course of Metallurgy, one lecture or recitation a week.

During the first session Professor Ricketts lectured twice a week on Assaying to the Third-Year Mining Engineers and Geologists, and F. M. Simonds, E.M., Assistant Instructor, held the recitations on the same subject. During the second session Professor Ricketts lectured twice a week to the Third-Year Chemists and Metallurgists, and Mr. Simonds held the recitations. Professor Ricketts also gave instruction in the Theory and Practice of Ore Testing to the Third-Year Mining Engineers, Geologists, and Metallurgists.

The students in the course of Analytical and Applied Chemistry in the Fourth Year have had special instruction from C. E. Colby, E.M., Instructor in Organic Chemistry. He has lectured to them four times a week throughout the entire year, and F. D. Dodge, Ph.B., has held recitations on the subject of the lecture once a week. They have also devoted a large part of their time to the practical study of Organic Chemistry in the laboratory.

In addition to the above instruction in the lecture and recitation room, the students have practised the various branches of chemical analysis, etc., as follows :

The First-Year students—Qualitative Analysis, under Dr. Wells and Dr. Vulté.

The Second-, Third-, and Fourth-Year students—Quantitative Analysis, under Professor Waller and Mr. Bowen.

The Third-Year students—Assaying, under Professor Ricketts and Messrs. Simonds and Banks.

The Fourth-Year students—Organic Analysis and Investigation under Mr. Colby and Mr. Dodge.

I submit herewith the accompanying reports from Professor Waller, on the work in Quantitative Analysis ; from Professor Ricketts, on the work in Assaying ; from Dr. Wells, on the work in Qualitative Analysis ; from Mr. Colby, on the instruction in Organic Chemistry ; and from Dr. Wiechmann, on the instruction in Chemical Physics and Chemical Philosophy.

The general attendance and progress of the students have been very satisfactory.

Valuable additions have been made to the Chemical Museum, the most notable being a Sprague motor and a five-light dynamo, and some other valuable apparatus for the illustration of electric lighting in connection with the lectures on artificial illumination, presented by Dr. Thomas A. Edison.

Respectfully submitted,

C. F. CHANDLER,  
*Professor of Chemistry.*

Columbia College, May 2, 1889.

#### REPORT OF PROFESSOR WALLER.

*Lectures* have been delivered as follows :

To students in *Chemistry* of the *Second Year*—twice a week throughout the year.

To students in *Chemistry* of the *Third Year*—twice a week during the first session.

To students in *Metallurgy* of the *Second and Third Years*—once a week throughout the year.

To students in *Mining Engineering* of the *Fourth Year*—once a week during the second session.

*Recitations* have been held as follows by my assistant, Mr. H. C. Bowen :

For students in *Chemistry* of the *Second Year*—twice a week throughout the year.

For students in *Chemistry* of the *Third Year*—twice a week during the first session.

With the students in *Metallurgy* and in *Mining Engineering* I have occasionally held a recitation in place of a lecture, when it has seemed expedient.

*Examinations* have been held monthly for students in *Chemistry* of the *Second* and *Third Years*, and also at the close of the session for students in *Metallurgy* and in *Mining Engineering*.

*The laboratory* has been open seven hours daily for work by the students during five days of each week of the college year.

Students in *Chemistry* of the *Second Year* have been occupied with the examination of twenty-five different substances (comprising some sixty or seventy different determinations). Nineteen of these substances are ores, alloys, furnace products, etc.

Students in *Chemistry* of the *Third Year* have been occupied with the examination of eighteen different substances, affording practice in some of the most important analyses connected with industrial and sanitary chemistry.

Students of the *Second Year* in *Metallurgy* were at first occupied with the examination of certain pure salts, in order to acquire a fair acquaintance with analytical manipulations. Subsequently they worked upon analyses of ores, minerals, and furnace products. The work required of them was as follows :

#### FIRST TERM.

Barium chloride—Ba, H<sub>2</sub>O, Cl gravimetric & volumetric.

Magnesium sulphate—MgO, SO<sub>3</sub>.

Calcium carbonate—CaO, CO<sub>2</sub>.

Potassium alum—Al<sub>2</sub>O<sub>3</sub>.

Iron ammonia alum—Fe<sub>2</sub>O<sub>3</sub> gravimetric & volumetric.

Limestone—CaO, MgO, (Fe<sub>2</sub>O<sub>3</sub> & Al<sub>2</sub>O<sub>3</sub>), SiO<sub>2</sub>, CO<sub>2</sub>.

Manganese mineral—Mn.

Zinc ore—Zn.

#### SECOND TERM.

Iron ore—Fe, S, P, SiO<sub>2</sub>.

Pig iron—Si, S, P volumetric.

Spiegeleisen—Mn gravimetric and volumetric.

Steel—C colorimetric.

Chromic iron—Cr<sub>2</sub>O<sub>3</sub>.

Coal—H<sub>2</sub>O, volatile and fixed C, ash, S.

Slag—Complete analysis.

Students in *Metallurgy* of the *Third Year* have had a similar course of work, which, however, had to be somewhat differently arranged, on account of changes which had to be made as to the distribution of the time of the students in that class. The work required of them was the same as given above, with the *omission* of manganese mineral, zinc ore, and chromic iron, and the *addition* of copper ore and galena. Most of them, however, by diligent application, have succeeded in performing the analyses which were omitted from the list of those *required* from the Second Class, and have done some of the work which will be required of students of the Third Class in the course in Metallurgy hereafter.

Students in *Mining Engineering* of the *Fourth Class* have been engaged in the study and practice of a few of the most important rapid methods of analysis in use in metallurgical works in the country. The list of analyses required of these students is as follows :

Magnesium sulphate—MgO, SO<sub>3</sub>, H<sub>2</sub>O.

Potash alum—Al<sub>2</sub>O<sub>3</sub>.

Iron ammonia alum—Fe<sub>2</sub>O<sub>3</sub> gravimetric, and volumetric by K<sub>2</sub>Mn<sub>2</sub>O<sub>8</sub> and by K<sub>2</sub>Cr<sub>2</sub>O<sub>7</sub>.

Zinc ore—Zn.

Iron ore—Fe, SiO<sub>2</sub>, S, P.

Pig iron—Graphite, S, Si, P volumetric.

Spiegeleisen—Mn gravimetric and volumetric.

Steel—C. colorimetric.

Copper ore—Cu, electrolytic and volumetric.

Coal—H<sub>2</sub>O, volatile and fixed C, Ash, S.

In addition to those having Quantitative Analysis as a part of their course, the laboratory has been used by some *Post-Graduate* students for the study of analytical chemistry as applied to general or special branches.

Mr. E. Van Dyck was Honorary Assistant in the laboratory during the first part of the year. When he left that position, Messrs. W. D. Jones and A. Dow were appointed Honorary Assistants. Mr. Jones has since been obliged to leave his position here.

Respectfully submitted,  
ELWYN WALLER, Ph.D.,  
*Professor of Analytical Chemistry.*

#### REPORT OF PROFESSOR RICKETTS.

The first term I delivered two lectures per week on assaying to the Third-Year Mining Engineers and Geologists. The assistant instructor, Mr. Francis M. Simonds, had charge of the recitations, and, together with Mr. John H. Banks, Honorary Fellow in Assaying, assisted in conducting the laboratory instruction.

In the second term I have lectured twice a week, and have held the recitations in assaying, assisted by Mr. F. M. Simonds. In addition to the instruction in assaying, I have given instruction in Ore-Testing to the Third-Year Mining Engineers, Geologists, and Metallurgists; also to post-graduate students. The average standing of the students has been very satisfactory, and the quality of the work done excellent.

The new furnace arrangements, made a year since, continue to give entire satisfaction, and are undoubtedly superior to those generally in use in other institutions.

In the Ore-Testing works there has been added a small amalgamator and settler for assaying ores for the purpose of determining the amount of free gold contained in the same. This machine has been donated to the school by Mr. Wm. H. Moller, and will, I think, prove very instructive and useful.

Very respectfully,  
P. de P. RICKETTS,  
*Professor of Assaying.*

#### REPORT OF DR. WELLS.

The students attending this branch of Analytical Chemistry are those of the First Year, in the courses of Analytical and Applied Chemistry, Mining Engineering, Metallurgy, Geology, or Sanitary Engineering.

*Lectures*.—During the first term lectures were given twice a week on the reactions of the metals.

Shortly after the beginning of the second term, I was obliged to be absent for a month, owing to sickness in my family, during which time Dr. Vulté, Assistant Instructor in Qualitative Analysis, gave two lectures a week on the acids. Since my return I have met the class twice a week as before.

*Recitations*.—Dr. Vulté has held recitations throughout the year, meeting the class twice a week for that purpose.

*Laboratory Instruction*.—For work in the laboratory the class has been divided into two sections, attending on alternate weeks, the section not due in the laboratory being engaged in blowpiping or drawing.

On Saturdays, however, both divisions have been present in the laboratory.

The attendance has been prompt, and the progress of the class satisfactory.

Respectfully submitted,  
JAS. S. C. WELLS,  
*Instructor in Qualitative Analysis.*

## REPORT OF MR. COLBY.

My instruction has been confined to those students of the Fourth Class, who were pursuing the course in Analytical and Applied Chemistry.

*Lectures.*—I have lectured on Organic Chemistry to these students four hours each week throughout the year, and Mr. Dodge has held oral recitations on the subject once a week. In addition to this, written examinations were given every month. The lectures in the first session treated of the methods of analysis and determination of the physical properties of organic bodies in general, and the formation and decomposition of compounds of the fatty series. During the second session the subject discussed was the derivatives of benzene or compounds of the aromatic series. Special lectures were given upon the pyridine and chinoline bases, and attention was called to those compounds which have recently found application in medicine and the arts.

*Laboratory Work.*—The course of instruction in the laboratory was substantially as set forth in the Handbook of Information for the year. Each student has had experience in the analysis and synthesis of organic bodies, and has prepared at least thirty organic compounds and identified them. The students also made a number of artificial dyestuffs and applied them to cotton, wool, and silk. The attendance in the laboratory has averaged twenty-four hours a week to each student. During all the hours devoted to laboratory work the students constantly received informal instruction and individual assistance from Mr. Dodge and myself.

The progress of the class has been very satisfactory, and the students have manifested great interest in their work.

Respectfully submitted,

CHARLES E. COLBY,

*Instructor in Organic Chemistry.*

## REPORT OF DR. WIECHMANN.

The First-Year students, in the course of Analytical and Applied Chemistry, received instruction in Chemical Physics twice a week during the second term. The lectures given treated of: Matter, Motion, Force, Gravitation, Work, and Energy; the Three States of Matter; the Properties of Matter in these states; Weighing and Measuring. The recitations held were on the subject-matter of these lectures, and on lessons assigned in Cooke's Principles of Chemical Physics. Problems, illustrating the principles taught, were worked and discussed in class.

The Second-Year students, in the course of Analytical and Applied Chemistry, were met four times a week throughout the year. Instruction was given in Chemical Philosophy, treating of: the Constitution of Matter, Atomic Weights, Molecular Weights and Formulæ, Stoichiometry, Laws of Chemical Combination, Chemical Nomenclature, Relation of Gases to Temperature and Pressure, Diffusion and Dialysis of Liquids and Gases, Thermo-Chemistry, etc. The work done embraced lectures, recitations, and the demonstration in class of numerous problems. The text-book used was Cooke's Principles of Chemical Philosophy.

Very respectfully,

F. G. WIECHMANN,

*Instructor in Chemical Physics and Chemical Philosophy.*

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DEPARTMENT OF GEOLOGY AND PALÆONTOLOGY.

*Professor Henry Drisler, Acting President of Columbia College:*

I have the honor to present the following brief report of the work done in the Geological Department during the past academic year. I have given the following lectures:

1. In Economic Geology three lectures per week throughout the year to the Fourth Class in the School of Mines.

2. In General Geology three lectures per week to the Third Class of the School of Mines.

3. In General Geology to Senior electives in Department of Arts and Third-Year Class in the Department of Architecture, School of Mines, one lecture per week throughout the year.

4. A course of laboratory instruction in microscopic lithology has been given by Mr. F. J. H. Merrill, Fellow in geology, to a volunteer class of eight students belonging to the Third- and Fourth-Year Classes in the School of Mines.

5. Mr. J. I. Northrop has given a course of laboratory practice in Palæontology to one student in the geological course, and several volunteer students three hours per week throughout the year.

6. Mr. Hensoldt, assistant in Natural History, has been occupied in Curator's work, mounting and arranging specimens five days per week throughout the entire year.

The Geological Museum and the laboratory have occupied much of the time of Mr. Merrill, Mr. Northrop, and myself; much new material has been added which has been studied, labelled, and arranged; fully two hours a day each have been given to the work by Mr. Merrill, Mr. Northrop, and myself.

The additions to the cabinet during the past year are enumerated in the accompanying memorandum.

ADDITIONS TO THE CABINET FROM JUNE 30, 1888. TO MAY 1, 1889.

Economic Geology, number of specimens,	953,	value \$	780 00
Geology, " "	656,	"	1,066 00
Zoölogy, " "	244,	"	94 00
	<hr/>		
	1,853		\$1,940 00
Furniture cases . . . . .	2	"	800 00
	<hr/>		
	1,855	"	\$2,740 00

The Botanical Department has been in charge of Dr. Britton this year as last. I enclose his report of work done.

Yours very truly,

J. S. NEWBERRY.

Columbia College, New York, May 9, 1889.

REPORT ON THE SUB-DEPARTMENTS OF BOTANY AND ZOÖLOGY.

In the School of Arts instruction has been given in General Botany to an elective section of Juniors and Seniors by lectures accompanied by the free use of diagrams, specimens, lantern slides, and microscopic preparations, one hour per week; to an elective section of the Senior Class in the practical study of Histology and Morphology, one hour per week.

In the School of Mines instruction has been given to the entire First Class in General Botany, with especial reference to Palæontology, by lectures, one hour per week; to a First-Year student in the Geological Course in Morphology and Systematic Botany, two hours per week; to a Fourth-Class student in the same course, in General Botany, two hours per week.

Instruction in General Zoölogy with especial reference to Palæontology has been given to the Second Class with the exception of the students in the Course of Architecture, by lectures, one hour per week, and to a Fourth-Year student in the Geological Course practical work, two hours per week.

The care of the Herbarium and the answering of questions have occupied nearly all the remainder of my time—averaging not less than six hours per day. The large accessions received from the Royal Botanic Garden at Kew, together

with lesser consignments from other sources, have made the number of specimens added during the past year not less than 10,000. The Herbarium has been visited and used by many students, including persons from distant parts of the country.

The Botanical Library has been increased during the past year by the addition of 120 volumes and about 150 pamphlets. While this increase, if it could annually be carried out, would soon result in a very considerable number of books, it actually consists of not very much more than the current literature of the subject. There remain not less than 1,000 volumes, some of them long ago published, and now difficult to obtain, which are needed to make the collection of botanical books measurably complete.

Respectfully submitted,

N. L. BRITTON,  
*Instructor.*

#### DEPARTMENT OF MECHANICS.

To H. Drisler, LL.D., Acting President of Columbia College :

I have the honor to report that the students of the *Third Class* of the School of Mines have, for convenience of instruction, been divided into *three* sections, the first *two* embracing those required to study *Analytical Mechanics*, and the *third* embracing the students in Architecture, who are only required to pursue a course of Elementary Mechanics.

The first two sections, as a class, have attended me for the general purposes of lecture and experimental illustration ; for recitation and drill I have received the *first* section, whilst the second section has attended Professor Rees. Time, two hours per week.

The *third* section attended Professor Rees during the first term for *recitation*, and during the second term they attended my course of experimental lectures to the Junior Class, in both cases one hour per week.

Very respectfully,

WM. G. PECK.  
*Professor of Mechanics, etc.*

#### DEPARTMENT OF MATHEMATICS.

Professor H. Drisler, LL.D., Acting President of Columbia College :

I have the honor to report that, during the past year, the first and second classes have attended in mathematics as follows :

The first class, three times in sections, and once as a class—in all four times per week ;

The second class—four times per week ; and have each completed the prescribed curriculum. Opportunities have been given for mathematical work not included in the required courses, of which some of the more proficient students have availed themselves.

Two graduates of the school have been pursuing advanced courses, one in Quaternions and one in higher Calculus. An account of their studies is given in my report upon the higher mathematics in the graduate department of the School of Arts.

Respectfully submitted,

J. H. VAN AMRINGE,  
*Professor of Mathematics.*

Columbia College, School of Mines, March 30, 1889.

## DEPARTMENT OF PHYSICS.

## FIRST YEAR CLASS.

The First-Year Class was engaged for three hours per week during the first term on the subjects of Magnetism, Electricity, and Optics, as follows :

Properties of magnets ; magnetic induction ; difference between magnets and magnetic substances ; magnetic attractions and repulsions ; terrestrial magnetism ; frictional electricity ; electrical attractions and repulsions ; electrical capacity ; electrical potential ; electrical induction ; electrical machines ; Leyden jar ; voltaic batteries ; polarization ; galvanometer ; tangent compass ; Ohm's law ; luminous, heating, and chemical effects of batteries ; electro-metallurgy ; attraction and repulsion of currents ; electro-magnets ; electric telegraphs ; electro-motors ; voltaic induction ; magneto-induction ; inductorium ; magneto-electrical machines ; telephone ; microphone ; phonograph ; thermo-electric currents.

*Optics.*—Velocity of light ; photometers ; reflection ; plane, concave, and convex mirrors ; spherical aberration ; index of refraction ; prisms ; lenses ; spherical and chromatic aberration ; spectroscope ; lines from the sun and stars ; phosphorescence ; fluorescence ; optical instruments ; simple and compound microscopes ; photographic camera ; astronomical and terrestrial telescopes ; human eye ; ophthalmoscope.

*Second Term.*—Coefficients of expansion of solids, liquids, and gases ; thermometers ; compensated pendulum ; fusion ; latent heat ; solution ; tension of vapors ; liquefaction of vapors ; hygrometry ; conduction by solids, liquids, and gases ; radiant heat ; steam-engine.

*Sound.*—Nature of sound waves ; velocity of sound in solids, liquids, and gases ; reflection and refraction of sound ; noise and musical tones ; measurement of length of sound waves ; interference ; laws of vibrating strings ; musical scale ; vibrations of rods ; flute pipes ; reed pipes ; vibrations of plates ; resonance ; clang-tint ; the voice ; the ear.

## THIRD YEAR CLASS.

The Third-Year Class was engaged two hours per week during the first and second terms as follows :

*First term.*—First law of mechanical theory of heat ; experiments of Joule, Rowland, and Hirn ; indicator diagrams ; isothermals of gases, liquids, and solids ; adiabatic curves ; isothermals of steam ; Carnot's engine ; second law of mechanical theory of heat ; steam-engines and caloric engines ; specific heat of solids, liquids, and gases ; kinetic theory of gases ; physiological applications of theory of heat.

*Electricity.*—Electrical units ; constants of a battery ; Wheatstone bridge ; resistance ; electro-motive force ; potential ; dynamos ; thermo-dynamics of a battery ; theory of dynamos and motors.

*Undulatory theory of light.*—Reflection and refraction ; interference of light waves ; measurement of length of waves ; double refraction ; plane, circular, elliptical polarization ; conical refraction.

## POST-GRADUATES.

A small number of Post-graduates were engaged two hours per week during the first and second terms in making measurements of length with dividing engine and cathetometer ; determinations of angles of crystals with goniometer ; radii of lenses with spherometer ; specific gravities of solids and liquids with balance and otherwise.

Respectfully submitted,

O. N. ROOD.

*Professor of Physics.*



## DEPARTMENT OF ENGINEERING.

*Doctor Henry Drisler, Acting President of Columbia College :*

I have the honor to present the following report of the operations of my Department for the last year.

The summer schools of Practical Mining, Surveying, and Mechanical Engineering were held successfully and with increased interest on the part of the students, during the last vacation. The School of Practical Mining, under Adjunct Professor H. S. Munroe, with Mr. Ira H. Woolson, Assistant in the Drawing Department, as principal assistant, and Mr. D. F. Haasis as volunteer assistant, was held at Lake Superior, and occupied six weeks. The Summer School of Surveying under Adjunct Professor H. S. Munroe, with Mr. R. E. Mayer, Assistant in Drawing Department, as principal assistant, and Mr. W. H. Stuart (Fellow in Engineering), F. W. Denton, and D. L. R. Dresser, as volunteer assistants, was held at Litchfield, Conn., as usual, and occupied six weeks for the students, and about eight weeks for the assistants.

The Summer School of Mechanical Engineering under Adjunct Professor F. R. Hutton, with Mr. G. S. Percival, Henry Lipps, and W. D. Gardner, as volunteer assistants, was held, as is the custom, in New York City and vicinity, and occupied about four weeks. As full reports have already been handed in relating to these Summer Schools, it is unnecessary for me in this report to say more than to highly commend the officers who have had charge of them ; and to state that the work required of the students is systematically laid out and faithfully supervised. The students work hard and take great interest in the practical exercises, from the beginning to the end of each term of the schools.

The course of instruction in the Engineering Department remains substantially the same as for the last year ; the only exception being that improvements in methods and scope of instruction which are suggested by experience, or made advisable by the increasing capabilities of the students, have been introduced. It is quite apparent that although there has not been any marked increase in numbers in the higher classes of the School of Mines, there has been a notable improvement in the qualifications of the students as a whole, demanding on the part of the instructors a higher standard of instruction.

I cannot too highly commend the zeal and faithfulness of the instructors in the Engineering Department, who endeavor by constant, patient, and assiduous work, by lectures and by personal conference to stimulate the enthusiasm of the students and to lead them to put forth their best efforts in investigation and in the acquisition of the fundamental principles which constitute the groundwork of the professions.

During the year a very important acquisition to the apparatus for investigation has been conditionally secured through the efforts of Professor Hutton, in the purchase of a testing machine built by the Towne Manufacturing Company of Stamford, Conn., and known as the Emery Testing Machine. This apparatus is probably the finest testing machine in this country, and is capable of testing the tensile and compressive strength of materials to the extent of seventy tons per square inch. No other institution in this country, as far as I know, possesses so valuable a machine of this character.

The Trustees having provided for a post-graduate course in Electrical Engineering, it is hoped that this branch of instruction may be effectually begun during the first term of the coming year ; and it will be my aim to make the instruction as thorough and the standard as high as possible.

Mr. Stuart, Honorary Fellow, has attended all the lectures of Dr. Billings, according to the directions of the Faculty, and has, with the aid of Dr. Billings, prepared questions on the course of lectures which constitute the basis of the quizzing exercises held on special days. Mr. Stuart has also conducted recitations on "Roads and Pavements" with the students in Engineering of the Second Class, thereby saving the time required for these recitations in the

Third Class, and giving that much more time to the class in the higher branches of engineering.

The courses of instruction in Drawing and Engineering Design have been very materially improved as the students become more advanced in general qualifications at the time of entering the School of Mines.

Very respectfully,

W. P. TROWBRIDGE,  
*Professor of Engineering.*

Columbia College, April 23, 1889.

#### DEPARTMENT OF GEODESY AND PRACTICAL ASTRONOMY.

*To the Acting President of Columbia College :*

I have the honor to report as follows on the work of my department :

(1) The *Fourth Class* in Geodesy, numbering twenty-three students, has met me twice a week for lectures and recitations on the following subjects :

- (a) Spherical coördinates used in astronomy.
- (b) Time—mean solar, apparent solar, sidereal, and standard time.
- (c) Mathematical theory of the transit instrument in the meridian.
- (d) Mathematical theory of latitude determinations by the sextant and by the zenith telescope.

- (e) Theory of longitude determinations.
- (f) Mathematical theory of azimuth determinations of the first class.
- (g) Practical applications of the "method of least squares" to the reduction of transit observations, and to the adjustment of a triangulation net.

- (h) Pendulum observations for determining the figure of the earth.
- (i) Magnetic observations for determining declination, inclination, and intensity.

- (j) The use of the "method of least squares" in obtaining empirical formulæ.
- (2) The *Third Class* in astronomy and geodesy, numbering nineteen students, has attended two hours a week. During the first term the subject of "general astronomy" was gone over, using Peck's *Popular Astronomy*, and supplementing the text-book with illustrated lectures on telescopes, solar system, time, moon, sun, planets and planetoids, comets and meteors, and stars and nebulae. As usual during the second term, the subject of "geodesy" has been dealt with. The text-book, Gore's *Geodesy*, has been supplemented by lectures on direction and repeating theodolites, micrometer-microscopes, heliotropes, base apparatus, comparators, signal tripods and towers, barometric hypsometry, trigonometric levelling, etc.

- (3) The work of the summer class in practical geodesy has been made the subject of a special report as you desired.

Respectfully submitted,

JOHN KROM REES,  
*Professor of Geodesy and Practical Astronomy.*

Columbia College, April 4, 1889.

#### DEPARTMENT OF ARCHITECTURE.

*To the Acting President of Columbia College :*

In a paper which I addressed to President Barnard at the time this department was organized, eight years ago, I expressed a hope that it might be possible to set on foot a sort of architectural laboratory in which our students might become acquainted with the practical details of plumbing, painting, masonry, etc., so as to become better judges of work than the ordinary experience of office work would make them.

Lack of space even more than lack of time has prevented the fulfilment of this hope, the room devoted to this work having been needed for other things. But a year ago Mr. R. T. Auchmuty suggested that perhaps the same thing might be effected at the Trade Schools for Mechanics, which he had established at the corner of 1st Avenue and 67th Street, and the permission of the Trustees having been obtained, it was accordingly arranged that the Third and Fourth-year classes should, this winter, spend every Wednesday afternoon at the Trade Schools, taking lessons in plumbing and masonry. These continued from the middle of November to the middle of April, and though subject to drawbacks incidental to the first trial of the experiment, the results were eminently satisfactory, both to the students and to the managers of the schools.

Early in March a volunteer force of half-a-dozen of the class employed their newly acquired skill one Saturday in trying a very successful experiment in bricklaying, executing a barrel-vault in the Byzantine manner, with inclined courses and without centring.

The rest of the work of the department has gone on very much as described in my last year's report, the only important change being that while the First-year class have read a French text-book, as last year, the Second class have substituted a text-book in German, materially increasing their acquaintance with the German language and especially with German technical terms, rehearsing in that tongue the commonplaces of archaeology and architectural history. These French and German readings are amply illustrated with drawings, diagrams, and photographs, and with books taken out of the general College Library, as well as with those on our own shelves. Altogether they make an interesting and instructive addition to the work in hand.

For the rest, the methods adopted last year and described in last year's report have been followed without substantial modification. Some minor changes have suggested themselves, which may perhaps next year be put in practice.

The total number of students in the department has been 66, in place of 54 last year, and 45 the year before. The most noticeable feature in this increase of numbers is that it is due largely to an increase in the number of graduate students, most of whom have entered the department in advanced standing.

Of these there are now 16 in the department, making a fourth of the whole number, who have previously taken a degree in some college or scientific school. They have come from Harvard, Yale, Williams, Princeton, Kenyon College, and the University of California, besides graduates from our own College, both of the School of Arts and of the School of Mines.

Respectfully submitted,

WILLIAM R. WARE,  
*Professor of Architecture.*

May 13, 1889.

## REPORT ON BIOLOGY AND HYGIENE.

*To the Acting President of Columbia College :*

I have the honor to report that during the past year, instruction has been given to the students of the Second class in the School of Mines, in biology and hygiene, in accordance with the schedule given in the Circular of Information of 1889-90, pages 80-81. Two courses of lectures on these subjects have been given. The first given in November and December, 1888, upon general Biology, first help in Accidents and Injuries, Vital Statistics, and some of the principal causes of Disease.

The second course was delivered in March and April of the present year, and was devoted chiefly to matters connected with the municipal sanitary engineering.

The laboratory course of instruction in Microscopy and Biology for the

Chemists of the Second and Third classes has been continued through the year, as shown by the report of Dr. Julien. The results of the year's work are believed to have been satisfactory. The results of the quizzes and examinations held by Mr. Stuart in his lecture, indicate interest and intelligent attention upon the part of the class.

Respectfully submitted,  
JOHN S. BILLINGS,  
*Lecturer on Biology and Hygiene.*

Columbia College, May 3, 1889.

#### REPORT OF DR. JULIEN.

Two classes of students in the Second and Third Year of the Chemical Course have been at work in my laboratory during the past year. As usual, the main instruction has been given through practical work, accompanied by lectures wherever needed.

The students of the Second Year have attended four hours each week, and have learned the theory and use of the microscope and methods of mounting, and some of the more important applications of the instrument to purposes of interest to the chemist, viz.: the examination of fibres and textile fabrics, paper, handwriting, and forgeries; the detection of adulterations in foods, on specimens now sold in the city; micro-chemical examinations; the detection of poisons by microscopical methods; the identification of blood-stains, examination of urinary deposits, absorption-spectra, refractive indices, and the manipulation of high-power objectives.

The students of the Third Year have also spent four hours per week in learning practically the art of photo-micrography, the study of some of the lower organisms, such as yeasts, moulds, fresh-water algæ, infusoria, etc., and especially the subject of bacteriological investigations in general, and particularly of species affecting the sanitary character of air and of the drinking water of our cities. I am happy to report that I have never had a class which has made such progress as this.

Respectfully submitted,  
ALEXIS A. JULIEN.

#### REPORTS ON SUMMER SCHOOL WORK.

##### SUPPLEMENT TO APPENDIX B.

##### A. SUMMER SCHOOL IN PRACTICAL GEODESY.

##### *To the Acting President of Columbia College :*

I have the honor to submit herewith my report on the work of the Summer School in Practical Geodesy for the year 1888. The class began work on Monday, June 11th, at 9:30 A.M., and was dismissed on Wednesday, July 25th. From June 11th to June 30th the class remained in New York City, engaged in observatory work. On July 2d the class reported for duty at Cooperstown, N. Y., where the field work was continued. The State Engineer, John M. Bogert, C.E., loaned the class several very fine instruments, which enabled me to divide up the work by squads more advantageously than otherwise I could have done. I was assisted during the summer by Lea McI. Luquer, C.E., and E. L. Stabler, Ph.D.

The class numbered twenty-four (24) students.

Besides the observatory and field work, the students were required to write memoirs on the following subjects :

- I.—The Columbia College 10-in. Direction Instrument fully described and illustrated (with cross-sections and photographs). With methods of adjustments and of measuring angles by "single angle" and by "directions." Messrs. Massa and Monell.
- II.—Machines and methods for graduating circles. Messrs. A. Smith and Stoughton.
- III.—Automatic recording instruments for meteorological purposes. Messrs. Dresser and Wainwright.
- IV.—Forms of base-measuring apparatus from the earliest times to the present day. Messrs. Berry and Whitlock.
- V.—Methods used in making telescope lenses and testing the same. Messrs. Luquer and Schroeder.
- VI.—Forms of Transit instruments and of chronographs, with electric connections. Messrs. Preston and Oseransky.
- VII.—Forms of instruments used in measuring distances,—*i. e.*, telemeters. Messrs. Volckening and Ives.
- VIII.—Forms of angle-measuring instruments from the earliest times to the present day. Messrs. Harrington and Freedman.
- IX.—Time-distributing operations from Washington, Harvard College, and N. Y. City.
- X.—Description of function, apparatus, etc., of the Bureau of Weights and Measures, Paris. Messrs. Fowler and Klapp.
- XI.—Description of the different forms of signals used in Geodetic surveys—poles, towers, heliotropes, night lamps, etc. Messrs. Denton and Provost.
- XII.—The application of photography to topographical surveying. Mr. Gildersleeve.

Several memoirs show painstaking care and intelligent reading, as well as practical acquaintance with the subjects discussed.

I give below the outline of the work required of the whole class:

- I.—1. Use of the Almanac for calculating elements needed in reductions.  
2. Conversion of mean time into sidereal time and *vice versa*, and apparent time into mean time and *vice versa*.  
3. Values of level divisions obtained by means of the "level trier."
- II.—Sextant.  
1. Construction of the instrument.  
2. Theory of the instrument.  
3. Adjustments.  
4. (a) Angle measuring.  
(b) Time by single altitudes of sun employing artificial horizon.  
(c) Time by equal altitudes of the sun—(art. hor.)  
(d) Latitude by single altitudes of Polaris (art. hor.)  
(e) Latitude by single altitudes of the sun (art. hor.)  
(f) Latitude by circummeridian altitudes of the sun or stars (art. hor.)  
(g) Time by altitudes of stars.  
(h) Longitude by Lunar distances.  
(i) Latitude and Longitude by Sumner's method.
- III.—Transit Instrument Clock and Chronograph.  
1. Construction.  
2. Theory of instruments.  
3. Adjustments.  
4. Star lists and tables.  
5. Observations and reductions for constants and time error of clock.
- IV.—Base measuring.  
1. Construction of apparatus.  
2. Adjustments.  
3. Measurement of a base and reduction of observations.

- V.—Angle measuring by “repetitions.”
    - 1. Construction of instruments.
    - 2. Adjustments.
    - 3. Observations and reductions.
  - VI.—Angle measuring by “directions.”
    - 1. Construction of instrument.
    - 2. Adjustments.
    - 3. Observations and reductions.
    - 4. Night observations.
  - VII.—Determination of the true meridian, and the azimuth of a line.
    - 1. Theory of methods.
    - 2. Observations and reductions.
  - VIII.—Trigonometric levelling.
    - 1. Theory of methods.
    - 2. Observations and reductions.
  - IX.—Barometric hypsometry.
    - 1. Construction of instruments.
    - 2. Adjustments.
    - 3. Formulæ and tables.
    - 4. Observations and reductions.
  - X.—Terrestrial magnetism.
    - 1. Construction of instruments.
    - 2. Adjustments.
    - 3. Theory of methods.
    - 4. Determination of constants.
- N. B.* Reports must be made on the printed blanks furnished, and the observations must accompany the report. Observations must be reduced very shortly after they have been made.
- I submit with this report :
- (a) Blanks used for calculations of observations.
  - (b) Records of base-line measurements and their reductions.
  - (c) Records of angle measurements and their reductions.
  - (d) The sets of calculations by each student on the various pieces of work demanded by the scheme.
  - (e) The several memoirs.

Respectfully submitted,

JOHN KROM REES,

*Professor of Geodesy and Practical Astronomy.*

School of Mines, Columbia College, New York, March 2, 1889.

#### B. SUMMER SCHOOLS IN PRACTICAL MINING AND SURVEYING.

*Professor Henry Drisler, Acting President Columbia College :*

I have the honor to transmit herewith the reports of Professor H. S. Munroe on the Summer Schools of Practical Mining and Surveying,—the former held in the mining regions of Lake Superior, and the latter at Litchfield, Connecticut,—during the last summer vacation.

The very satisfactory progress of these schools in the direction of increased efficiency and extended scope of instruction, each year, is due to the constant devotion of Professor Munroe and his assistants to the personal instruction of the students and to the aims and objects for which the summer schools were established.

Greater success could hardly have been asked or anticipated.

Very respectfully,

W. P. TROWBRIDGE,  
*Professor of Engineering.*

New York, April 18, 1889.

## SUMMER SCHOOL OF PRACTICAL MINING.

The twelfth session of the Summer School of Practical Mining was held in the Lake Superior copper and iron regions during June and July, 1888.

Mr. Ira H. Woolson, E.M., instructor in Practical Mining and in Drawing, and Mr. Dunbar F. Haasis, E.M., served as assistants.

Fifteen students attended the school, as required by statute.

The same general plan of work was followed as in previous years. The greater part of the time was spent at the Atlantic copper mine, near Houghton, in careful and detailed study of the mine plant and of the various operations of mining. On the completion of this work visits were made to other mines and points of interest in the copper and iron regions.

At the Atlantic mine we received a most hospitable welcome, and during our stay both officers and men did every thing in their power to make our visit pleasant and profitable. The difficulty of providing satisfactory accommodation and board for the students was overcome this year by the use of the tents recently purchased. Floors for the tents, and portable oil-stoves for heating, made the tents comfortable even in the coolest and most inclement weather. The floors were made in sections, and have been stored at the mines for use another year. A cook was engaged at Cleveland, and most of the necessary supplies were obtained at the mine store at a small advance over cost price. The cost of board to the students was about eight dollars a week.

The work of the students this year at the Atlantic mine was very creditable, and they brought away with them note-books well filled with sketches and descriptions of mine plant and mining methods. By preliminary talks to the class each morning, by personal instruction during the day, and by examination and criticism of the note-books at night, the student is taught what to study and observe, and how to record his observations. This careful instruction and drill has proved most useful. The students are trained in habits of minute, systematic, and careful observation, which cannot fail to be of service to them in their subsequent professional work. Entirely apart from the value of the observations and notes to them as students of mining, the training that the students receive in taking notes would of itself justify the time devoted to the summer school.

The pedagogic value of the summer school, as an introduction to the technical lectures of the ensuing year, is, however, the chief reason for its existence. It supplies the place of laboratory work in chemistry and physics, or clinical instruction in medicine, in giving the student the necessary foundation upon which to base his ideas. A course of lectures by a professional accountant on the intricacies of book-keeping would be almost incomprehensible to a student who had never seen a ledger. The subject of mining engineering is in special need of such preliminary object-teaching, dealing as it does with the details of work carried on below the surface of the ground, in distant regions more or less mysterious even to those living in the immediate vicinity, and quite removed from the every-day experience of the student. Many of our students have never been in a mine before coming to the school. To such men, but for the advantages offered by the summer school, a lecture on the details of underground work would convey very vague ideas of mining methods. The conceptions of such student would in many cases be as grotesquely unlike actual practice as the ideas formed in the brain of an African chief from his guest's description of the wonders of a city house, with its modern conveniences and its æsthetic appointments. Obviously the more complete the student's knowledge of mining work, the more he will gain from a critical lecture on mining methods. It is with this in view, among other things, that the student's study is made as minute as possible and so much of the time of the summer school is spent at one mine.

On the completion of the work at the Atlantic mine a week was spent in visiting other mines in the copper and iron region, including the Copper Falls and Central mines on Keweenaw Point; the surface workings and dressing works of Calumet and Hecla; the new vertical shaft and deep workings, on the

Calumet deposit, of the Tamarack Mining Company; the Quincy mine, and the smelting works of the Detroit and Lake Superior Copper Company. In the iron region the Champion, Barnum, Lake Superior, and Cleveland iron mines, and the Ropes and Michigan Company's gold mines, in Marquette County, were visited and examined. In the light of their previous studies at the Atlantic mine, the students found much that was new and interesting at each of the mines visited.

Finally, before the class disbanded, each student was assigned some mine or mining region for independent study, or some subject connected with mining which would require him to visit mines other than those included in the regular course. Beside their regular and required work, many of the class voluntarily continued their practical studies throughout the summer, and some devoted the Christmas holidays, as well, to visiting mines and metallurgical works.

Messrs. J. H. Woolson and D. F. Haasis deserve especial commendation for the zealous and efficient assistance rendered by them in the work of the summer school; and, as in past years, we are greatly indebted to the owners, officers, and men of the different mines visited for their courteous and hospitable attentions. Our thanks are especially due to those connected with the Atlantic mine, where we made so long a stay, and which mine has several times been made our head-quarters in the copper region. It is to be hoped that before long our friends in the mining regions may begin to reap some advantage from their kindness and interest in our work. Our repeated visits to the Lake Superior mines has not been without result, as is evidenced by the increasing number of our graduates finding employment in responsible positions in the region. The summer school has perhaps, directly or indirectly, been the cause of the establishment of the Michigan Mining School at Houghton, where one of our graduates now fills an important position in the faculty.

Respectfully submitted,  
HENRY S. MUNROE.

Columbia College, April 17, 1889.

#### SUMMER SCHOOL OF SURVEYING.

The fifth session of the Summer School of Surveying was held at Litchfield, Conn., in August and September of last year.

The following served as assistants, as provided by resolutions of the Trustees, viz., Mr. Ralph E. Mayer, C.E., Assistant in Surveying and Drawing; Mr. William H. Stuart, C.E., Fellow in Engineering and Honorary Fellow in Mathematics; Mr. D. L. Dresser, '89, and Mr. F. W. Denton, '89.

Forty-eight students attended the Summer Class as required by statute.

Of this number, fourteen are members of the present fourth class, who did not attend the Summer School of Surveying with their class the year before, or who failed to complete their work at that time. Thirteen are volunteers of the present second class who were allowed to take their surveying in advance of the regular time, in order that they might be able to take other work next summer, either with Prof. Hutton in the machine shop, or additional work in surveying.

Besides these, four students attended the Summer School for advanced work in topographical surveying.

The class assembled Saturday, August 11th, and began work the following Monday. The session lasted six weeks, terminating Saturday, September 22d. The head-quarters was at the Island House on Bantam Lake, near Litchfield. The students were accommodated in the hotel, in the barrack building, in tents, and in part at neighboring farm-houses. Those sleeping in the tents and in the barrack building took their meals at the Island House.

The plan of work followed closely the programme of previous years as detailed in the hand-book. The work of the class merits the highest commendation; the men working diligently, showing great interest in the solution of the surveying problems assigned them, and zeal in acquiring skill in the use of surveying instruments. Toward the end of our stay the work was interrupted by an



unusual number of rainy days. Had this rain come earlier the students in most cases might have made up the lost time by a little extra diligence. As it is, a larger number than usual will have to come again to Litchfield to complete the required amount of work.

The system of check-surveys has again proved its great value, as was pointed out in last year's report. Every measurement made by the student, of angle, or distance, or height, can be verified at once by the instructors. Incorrect methods of work are promptly detected, and the student's time and energy are thus economized, and not wasted in ill-directed and useless work. As the student is forced to use correct methods he gains a much greater degree of skill in a short time than would be possible if his results were not checked and controlled. The system is especially valuable with large classes, in which the individual student can receive but little personal instruction in the field from the professor in charge.

With the requirement of accuracy in the work, comes also the temptation, on the part of the lazy or incompetent student, to avail himself of the work of others. Most of the students, however, realize fully the advantages of the systematic course of work, and the necessity of acquiring skill by practice, and are not inclined to shirk their work, but rather disposed to repeat their measurements again and again to make sure of the results. The lines of survey are, however, so laid out as to make such comparisons difficult and unprofitable, and so as to encourage honest work as far as possible.

As an example may be cited the line of levels upon which the students are drilled in the use of the engineers' wye-level. This line of levels is more than a mile in length and runs over a hill about 160 feet high, and returns along a road at the foot of the hill to the starting-point. At the beginning are a number of benches, and no two squads start from the same bench at the same time, and each squad has a separate datum assigned. Each squad is required to determine the level of a spud at stations 100 feet apart, but at each station there are seven spuds, so that two squads will rarely have one in common; and even then, starting from a different bench and from a different datum, the level will not be the same. More work will be required, and more skill, to arrive at the results dishonestly than by legitimate work.

A secondary advantage, of very great scientific value, lies in the unusual opportunity afforded by the system of checks, of determining the average error, and the limits of accuracy, of different surveying instruments and methods of work.

For example, the difference in level of the starting benches is known, also the difference in the level of the spuds at each station. It is possible thus to reduce all the surveys to a common datum and to the same plug at each station. In one year we will have about twenty different determinations of the level of each plug, from which the true height and the error of each determination can be computed with a very small probable error.

The average error of twenty squads in closing on the starting bench after going over this line was 0.015 feet. This error is quite small for a line a mile in length and with a difference in level, up hill and down, equal to a rise of 320 feet. The error seems quite small when we consider that the error in a single sight, in setting the target on the rod, may be four or five thousandths. The final error is due to the balancing of numerous small errors, plus and minus, each time the rod is used. Further study of the work of the above twenty squads develops many interesting points. At the first 100-foot station the average error was 0.005 feet, at 200 feet 0.006, increasing gradually about a thousandth at each station to the 1,100-foot station, when the average error was 0.011 feet. From this point on, the increase in the error was more gradual. At the 1,900-foot station at the top of the hill the average error was 0.014, or nearly as much as the average error of the twenty squads in closing. From here to the end of the line the error was about constant, ranging between 0.013 and 0.017, the average error at all the stations being about the same as the closing error—viz., 0.015 feet. It appears then that the average error reached its maximum in the first one third mile, and in the last two thirds of a mile did not sensibly increase.

The study of the errors of the single squads at the different stations is very interesting, and exhibits the tendency of errors to balance. The following are the errors of one squad at the different stations in order, viz: + .008 + .010 + .001 + .001 + .011 + .004 + .011 + .017 + .019 + .022 + .018 + .018 + .017 + .018 + .017 + .012 + .017 + .007 + .008 + .010 + .007 + .005 - .003 - .000 - .001 - .003 - .003 - .001 - .006 - .003 - .010 - .015 - .005 - .005 - .003 - .010 - .009 - .000 - .007 - .010 - .014 - .014 - .013 - .012 - .003 - .009 - .005 - .011 - .006 - .016 - .026 - .009 - .007 .014 - .004 - .007 - .011 - .007. These errors show very careful work. After the first few stations the increase and decrease is gradual and regular, showing accurate and careful reading of the rod. The entire absence of clerical and arithmetical errors affords further evidence of careful work. The range of error, from + 0.022 to - 0.026, is quite large, especially when compared with the closing error of 0.007. The tendency of errors to balance is clearly shown. It is apparent also that a small closing error is not a reliable index of the accuracy of the work on the intermediate stations.

For measuring horizontal distances in transit surveys, we use a steel tape for accurate work, and a telemeter rod for rapid surveys when less accuracy is necessary. The tape used is a narrow and light ribbon of tempered steel, long enough to be stretched from one station to another, thus avoiding the errors of transfer which occur when a shorter tape is used. The measurements are corrected for temperature, for sag of tape, and for inclination. Care and skill are necessary, especially in the matter of applying the exact tension, for which the catenary corrections are computed. The tape must not be allowed to touch the ground at any point, or again the catenary correction will not be applicable. The temperature of the tape is assumed equal to that of the air.

Of the results reported by the students, 84 per cent. were within the limit of error allowed, viz.: 0.04 per cent. Of these but 4 per cent. exceeded 0.02 per cent. error; 20 per cent. were between 0.01 and 0.02 per-cent. error; and 60 per cent. of the measurements showed an error less than 0.005 per cent. The average error of 200 measurements was 0.006 per cent. Between stations 200 feet apart this would mean an error in distance of about one eighth of an inch. A part of this error is due to inaccuracy in the measurement of the vertical angle—as appears in the following table, showing effect of inclination :

Average error 100 measurements, 0° to 2½°,	0.0056.
“ “ 86 “ 2½° to 7½°,	0.0060.
“ “ 14 “ 7½° to 10°,	0.0080.

The results obtained in measuring distances with the telemeter are surprisingly accurate. A self-reading rod is used, on which distances to two feet can be read directly, and single feet can be estimated by bisection. More accurate results can be obtained by the use of target rods, but these are less convenient. The results obtained are shown in the following table.

Distance in feet.	Number of measurements.	Average error.	Per-cent. error.
50 to 200	45	0.54	0.39
200 to 250	111	0.62	0.27
250 to 300	50	0.68	0.25
300 to 400	39	0.77	0.21
Average	245	0.64	0.28

As already stated in this report, four students volunteered this year for an advanced course in surveying, viz.: Messrs. Escobar and Heinze of the graduating class, and Betts and Foye of the third class. These gentlemen continued the

work begun last year by Messrs. Eilers and Weekes, and executed the following surveys :

1. A reconnaissance triangulation, including the measurement of a base 6,000 feet in length with the steel tape, and the measurement of the angles of two quadrilaterals, with sides 10,000 to 17,000 long. Permanent stations were established on the top of Mt. Tom and Prospect Mountain, and a large number of subordinate stations were located from these points.

2. A topographical survey by compass and pacing of a plot of 200 acres determining levels and contours by barometric observations.

3. An odometer survey of 500 acres, the topographical features being determined by compass intersections and vertical triangulation with the Abney hand level.

4. A transit and stadia survey of a polygon seven miles in perimeter, determining the levels and contours with the water-level.

It was intended also to do some photographic work with the surveying camera, but it was not found possible for lack of time. It is hoped that we may be able to add photographic surveying to the course next year, as the method promises to be exceedingly useful.

Since the close of the summer school Mr. D. F. Haasis has been engaged in compiling a map of Bantam Lake and vicinity from the plane-table sheets of the past four years. Over forty surveys have been transferred to this map, which embraces two square miles of territory. When completed this will furnish an exceedingly detailed map of the region, and one that will be a credit to the school. During the coming season data will be obtained for the completion of this map, so that it may be issued next fall.

We are much indebted to the gentlemen of the "Island House Company," of Litchfield, for the permission to use their grounds for our head-quarters and camp, and to the property owners in the vicinity, who allow the students the privilege of surveying their lands.

Respectfully submitted,  
HENRY S. MUNROE.

Columbia College, April 17, 1889.

#### C. SUMMER SCHOOL IN MECHANICAL ENGINEERING.

*Professor Henry Drisler, Acting President of Columbia College :*

I have the honor to transmit herewith the Report of Professor Hutton, on the operations of the Summer Class in Mechanical Engineering during the last summer.

Notwithstanding the fact that attendance has always been optional, this school has been uniformly well filled with attentive and willing students, and the increase in the scope and efficiency of instruction, made possible by the appropriations allowed by the Trustees of \$500 for the use of the school, is a most noticeable feature in its progress. I beg to call your attention to the remarks of Professor Hutton on this subject.

Very respectfully,  
W. P. TROWBRIDGE,  
*Professor of Engineering.*

Columbia College, May 18, 1879.

#### REPORT OF PROFESSOR HUTTON.

In consequence of the liberality of the Board of Trustees of the College in making an adequate appropriation for the expenses of such a class this year, it became possible, without sacrificing its usefulness and practicability of aim, to

extend its scope with great advantage, and a very satisfactory beginning in this direction was made.

The primary object of the class was the same which has been fundamental from the beginning in 1878. It is sought by a sufficiently extended sojourn in an extensive machine-shop, to show to engineering students those processes and constructive limitations which are all-important in their effect upon engineering design. It is impossible to have the student thus acquire any manual dexterity, but he is enabled to study how the tool processes are carried out by the workman; he learns the important distinctions between good and bad work, and he sees a greater variety of practice than he could have access to as an apprentice. He also finds out what class of knowledge will be expected from one who will be called on to act as a superintendent, and the danger is lessened of his undervaluing the exactions and requirements of such a position.

The class began operations during the first week in June, immediately after the examinations were over, and kept steadily at work for three weeks. We were again most hospitably welcomed by the Delamater Iron Works of West 13th St. and the North River, and this was the more to be commented on this year from the fact that the whole establishment was in confusion and embarrassment as the result of a most destructive fire, which had destroyed one of the largest buildings of the establishment only a few weeks before our visit. Many thanks are due to Mr C. H. Delamater, and to the superintendent of the shop, Mr. A. H. Raynal, for the privileges of last summer. The fire made the visit perhaps more unusual, for the very reason that rebuilding of shops and erection of tools was proceeding continually during our stay, and the students had opportunity to see what can rarely be witnessed when every thing has been satisfactorily running for years.

As the result of adequate pecuniary provision for the class, it was possible to do this year what has been so much needed hitherto, and that is, to provide assistant instructors who accompanied the groups of students, and thus insured that they saw what was worthy of note where they happened to be. This has been before a great shortcoming of the possible advantages which might be derivable from the class, inasmuch as the head of the class could not be ubiquitous, and the untrained and inexperienced student would pass over or fail to notice points of great practical value, simply because he did not appreciate them in their relations. The continual presence of the professor's assistants, of whom there were three, graduates of the School, helped largely this year to mitigate the difficulty referred to, and provision for such assistance should be continued. Moreover, these helpers made possible a change which was of the nature of an improvement, inasmuch as the professor could arrange with their help and presence in the mornings with the class, to hold his "quiz" and conference in the *afternoon*. By this change, the students made their clinical studies in the morning, while they were fresh and unwearied, and the lecture-talk came after luncheon as a resting-spell when it felt good to sit down. In other respects, no essential changes were made from the routine of previous years as respects the fundamental carrying on of the School. Each student had for his guidance an "Outline of Study" (of which one is hereto appended), which made clear the objects to which his attentive study was directed.

The proper manning of the instructing force also made possible a most desirable extension of the School, and one which it is hoped may be even further broadened in the future. Heretofore, there has been little or no development of the plan of visiting several establishments with the class, for the reason that a large group, many of whom were out of earshot from the professor, could not benefit from such excursions, and when clustered to hear what might be said in explanations, the party was an occasion of annoyance to workers in the shops visited. With suitable assistance, however, the party can be properly subdivided and the visit made profitable. Under these conditions, by courtesy of the proprietors of the establishments, visits were made to the very extensive establishment of R. Hoe & Co., in this city, building printing-presses and other fine machinery; to the Continental Iron Works at Greenpoint,

where the special processes and facilities for making corrugated and welded boiler-work were specially noticeable; and a whole day was given to a visit to shops in the city of Paterson, N. J. Here we were the guests of Mr. Beckwith, graduate of the School of Mines, who escorted us to the forge in which his own work lies, in making shafts and other large engine forgings, and also through the Passaic Rolling Mill near by. In the afternoon, the entire time was taken up in a most thorough visit to the Cooke Locomotive Works, where we were most hospitably received. The thanks of all are most sincerely due to those gentlemen whose attentions made these visits so interesting and profitable. It is intended to extend this feature of this class even more widely hereafter, should time and other conditions allow.

The class separated at the beginning of the last week in June, with many expressions of interest and sense of profitable expenditure of time. The undersigned would express his indebtedness to his three assistants, Messrs. Watts D. Gardner, G. Sidney Percival, and Henry Lipps, Jr., of the class of '88 School of Mines, for their faithful and interested service as his assistants.

Very respectfully,

F. R. HUTTON,

*Adjunct Professor Mechanical Engineering.*

Columbia College, October 15, 1888.

#### SUMMER CLASS IN MECHANICAL ENGINEERING.

##### NECESSARY OUTFIT.

- One pair outside calipers (4 inches).
- One brass-bound rule (2 feet) graduated to  $\frac{1}{16}$  inch.
- One pair blue drilling overall pants.
- One note-book (3 x 6 inches or over), pencil or stylograph.

##### PLAN OF STUDY.

Each student will attend with note-book at the appointed shop, from nine to four.

He will study closely and critically the machinery, tool, or process which has been for that day the topic of clinical lecture by the instructor, taking full notes and illustrating them with free-hand sketches, with DIMENSIONS IN ALL CASES. Where the object is inaccessible (*e. g.*, roof-trusses), estimate dimensions by eye, and write "approx." under the title.

Students will also seize every opportunity to draw and describe all details of engines, and machinery in process of construction which are accessible to measurement. Such are—boilers, pistons, cross-heads, cranks, pillow blocks, valves, wheel arms, connecting-rods, eccentrics, stubs, governors, walking beams, gallows-frames, propellers, paddle-wheels, and such engine castings as valve-chambers, cylinders, bed-plates, etc.

It is intended that these note-books shall be the first of that series which every engineer will have, containing memoranda and "studies" of parts of machinery and constructions to which he may refer in his practice. It would be well in the evening of each day to work over the sketches of the day at home into a clean note-book for more permanent preservation.

##### OUTLINE OF COURSE OF STUDY.

###### I. BOILERS.

Describe the boilers; types, sizes, shape and length; how set; grates; domes; steam-chimneys, man- and hand-holes, tubes and flues; size and height of chim-

ney, course of gases from fire ; diameter and length of steam pipe joints ; support ; lagging. Feed-pipe ; feed-heater ; blow-off pipe ; sizes ; valves and apparatus. Gauges for water and steam. Pressures. Boilers over heating furnaces.

Study position of boilers with respect to :

- (1) Coaling and removal of ashes.
- (2) Delivery of smoke.
- (3) Condensation of steam.
- (4) Danger from fire and explosion.
- (5) Superintendence.

## 2. ENGINES.

Kinds ; sizes and proportions of cylinders ; Rpm., stroke, piston speed ; point of cut off ; side-valves, mechanism ; fly-wheel structure ; steam and exhaust pipe ; lubrication of cylinders and bearings ; governors, conductors.

Study position of engines with respect to :

- (1) Distribution of power.
- (2) Ease of attendance, etc.
- (3) Duties of engineer.

## 3. DISTRIBUTION OF POWER.

Sizes, speeds of main belt ; sizes of main pulleys ; sizes, speeds, and location of main shafts ; couplings ; hangers, forms, intervals, and lubrication.

Motion to shaft at angles ; use and structure of counter shafts.

*Pulleys* : Sizes, faces, arms, securing, oiling, clasp-pulleys, guide-pulleys.

*Belts* : Kinds, sizes, speeds, lacings, shifters, tighteners, open and crossed.

Other transmissions, by rope, chain, universal joint, flexible shafting, etc.

## 4. MACHINERY FOR HANDLING HEAVY WORK.

### TRAVELLING CRANES.

Support of rails ; trussing of crane-girders ; span ; speed of lift and of travel ; speed of driving rope ; capacity ; gearing and tackle used ; proportions of parts ; method of driving and controlling crab.

### PIVOT CRANES.

Location ; span ; height ; bracing ; foundation, structure and movement of buggy ; hoisting-gear ; capacity and speed of lift ; men required. Power cranes, motions and control.

### HOISTS AND TACKLING.

Situation ; dimensions ; capacity ; construction ; handling.

### TELEGRAPHS.

Fixed and pivoted. Trolleys and capstans.

## 5. CARPENTER AND PATTERN SHOP.

Study wood-working machine-tools.

*Saws* : Slitting, cross-cut, band, and jig. Lathes, beds, speed and swing, and face-plates.

*Planers, Matchers* : Bed, carriage and speeds, feeds and capacities of each.

Study hand-tools—what are they and how used.

Shrink-rules ; glues and varnishes and their preparation ; draught.

Division of patterns, dowels, core-prints and core-boxes. Draw-irons.

System of storage of patterns.

## 6. IRON FOUNDRY.

Size, shape, structure, foundations, lining of cupolas.

Capacity, charging, lift, mixtures, starting fires, tapping, dropping out.

Blast, pressure, how introduced, kind of blower.

*Ladles* : Form, size, structure, handles, tipping-gear.

*Sands* : Green, dry, facings, core-material, forming and baking. Washes.

*Flasks* : Cope, drag or nowel, loam casting, sweeps, core lathe, cleaning and pickling castings, rumbles.

Study processes of moulding, forming gates, and supporting cores.

Study processes of casting, skimming, avoiding shrinkage, strains, and explosions.

Note times necessary and economy of close casting.

BRASS FOUNDRY.—Alloys, moulds, furnaces, and crucibles.

#### 7. FORGING.

HEAVY.—Furnaces, blast, hammers, anvils and foundations.

Cranes—support, adjustment, and control.

How a large forging is built up and completed. Porter bar, time and men required. Upsetting, cutting off.

LIGHT.—Forges, kinds of fuel and fires, blast.

Hammers : Steam and power.

Hand-tools : Sledges, hammers, anvils, tongs, swages, chisels, flatters, fullers.

Processes : Heating, welding, upsetting, scarfing, fluxes, peining.

Tongue, scarf and butt welds. Drawing down, bending, cutting-off, punching in small bars.

Tempering and forging of steel.

Flanging of plate— anvils, mauls, vises, fires, etc.

Economy from close forging.

COPPER SHOP.—Brazing, galvanizing, spinning, babbiting.

#### 8. BOILER SHOP.

Shearing, bevelling, marking, pouching, drilling, boring, bending of plate.

Riveting, by hand and machine, drifting, reaming, calking, expanding tubes, cutting off and heading over.

Times required in each process.

#### 9. METAL WORKING MACHINE TOOLS.

Latches—Drills—Vertical lathes, and boring machines, horizontal and vertical ; turret lathes, bolt threaders, and nut tappers.

Planers—Shapers—Slotters.

Milling machines, gear cutters, profilers.

Emery wheels and grindstones, speed at surface. Buffing wheels.

Study :

(1) Motions of tool and work. How produced. Back-gear ; cone-pulleys, quick returns. Rmp. and speed, screw cutting.

(2) Centring and chucking. Time required. Forms of chucks, face-plates, dogs and drivers ; steady rests. Centring machines.

(3) Cutters—Forms, temper, cutting edges, spring, nature, and weight of chips, inaccessible places. Rotary cutters.

(4) Tool-rests and holders—motions, methods and directions of feed, depth of cut, time to finish one square foot.

(5) Boring bars and heads, star wheels. Use of open and solid dies for screw cutting.

Roughing and finishing out. Water finish.

#### 10. BENCH WORK OR FITTING.

Hammers : Chipping, by cold and cape chisels. Lining out. Centre punching.

Files : Sections, bastard, smooth, dead smooth, second-cut, safe edges, draw-filing by hand and machine, dies and stocks.

## 11. FLOOR WORK OR ERECTING.

Ratchet, hand and breast drills ; fly and twist drills.  
Portable boring bars, mills and drills. Extension and flexible shafting.  
Standing bolts, socket nuts ; wrenches. Assembling presses.

## 12. SUPPLY AND TOOL ROOMS.

Contents, system, repairs, gauges.

## 13. DRAWING ROOM AND OFFICE.

Equipment and labor. Time-keeping. Account system. Paying. Shop rules. Contract system. Superintendence. Helper system. Laborers.

## 14. GENERAL ENGINEERING FEATURES.

Sketch a ground plan of the plant (dimensions by paces) ; prepare, also, ground plan of each shop, showing position of each tool in it, with yard spaces and areas around each tool noted.

## STUDY PRINCIPLES OF ARRANGEMENTS OF BUILDING WITH RESPECT TO :

- (1) Transmission of power.
- (2) Progress of work through the shops.
- (3) Superintendence.
- (4) Ease of shipment of goods.

## STUDY STRUCTURE OF BUILDINGS WITH RESPECT TO :

- (1) Solidity to support shafting, etc.
- (2) Foundations and roof-trusses, floors, etc.
- (3) Combustibility in case of fire.
- (4) Windows, lighting and ventilation.
- (5) Convenient arrangement of tools.



## APPENDIX C.

### SCHOOL OF POLITICAL SCIENCE.

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*To the Acting President of Columbia College :*

The courses indicated in the Circular of Information of the School of Political Science have been given during the present year by the persons designated therein. The attendance has increased over that of the last year about 15 per cent. It has been also more uniform than in any previous year. It is the testimony of every member of the Faculty of the School that better work has been accomplished than in any previous year.

The Faculty of the School has suffered a serious loss in the resignation of Professor Alexander from the department of Political Theory.

The Academy of Political Science has preserved its activity during the present year, and has largely increased our fund of valuable material for future publication. The *Political Science Quarterly* has about doubled its circulation during the present year, and is, I think, gaining steadily in favor with its readers.

Respectfully submitted,

JOHN W. BURGESS,

*Senior Professor.*

School of Political Science, Columbia College, April 26, 1889.

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### DEPARTMENT OF POLITICAL ECONOMY AND SOCIAL SCIENCE.

*To the Acting President of Columbia College :*

In the Department of Political Economy and Social Science I have the honor to report that the following work has been done: In the School of Political Science, the First-Year class has followed the same course as the Seniors, mentioned in report on School of Arts.

The Second- and Third-Year men have had a course of lectures on Communism and Socialism, two hours per week through the year.

Respectfully submitted,

RICHMOND M. SMITH,

*Professor of Political Economy and Social Science.*

Columbia College, April 19, 1889.

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*To the Acting President of Columbia College :*

In the Department of Political Economy in the School of Political Science the following courses of lectures have been delivered by me :

To the Second-Year men two hours per week throughout the year on the Financial History of the United States.

To the Second- and Third-Year men two hours per week during the second session on the Tariff History of the United States.

To the Second- and Third-Year men three hours per week during the first term on the History and Criticism of Economic Theory.

I have in addition met the First-Year men every other week in the seminar, leading the discussion of original papers read by the students before the class.

Respectfully submitted,

EDWIN R. A. SELIGMAN,  
*Adjunct Professor of Political Economy.*

#### DEPARTMENT OF POLITICAL PHILOSOPHY.

*To the Acting President of Columbia College :*

Since the resignation of Professor Alexander in January, 1889, the lectures have been taken up in the usual manner, the First-Year men in the School of Political Science having received two hours per week throughout the second term on the History of Political Theories from Cicero to Rousseau.

Respectfully submitted,

EDWIN R. A. SELIGMAN,  
*Adjunct Professor of Political Economy.*

*To Prof. Henry Drisler, Acting President of Columbia College :*

I have the honor of submitting to you the following report of my work in the School of Political Science during the past academic year.

I have lectured three hours per week to the students of the Second Year upon the History of European Law, and three hours per week to the students of the Third Year upon Comparative Jurisprudence and International Private Law.

Very respectfully,

MUNROE SMITH,  
*Lecturer on Roman Law.*

Columbia College, May 3, 1889.

*Henry Drisler, LL.D., Acting President of Columbia College :*

I have the honor of reporting to you the work in the Department of Administrative Law in the School of Political Science. During the year I have lectured to the students three hours a week on General Administration and Financial Administration, and the Administration of Internal Affairs, and two hours a week on Local and Municipal Government. I am, yours respectfully,

FRANK J. GOODNOW,  
*Adjunct Professor of Administrative Law.*

Columbia College, May 3, 1889.

## APPENDIX D.

### SCHOOL OF LAW.

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*To the Acting President of Columbia College :*

The Warden of the Law School would respectfully report as follows :

The attendance of the students and their devotion to studies assigned to them by the statutes have been highly satisfactory. The Senior class has pursued the rules of Equity Jurisprudence under Professor Lee, and the topics of Evidence, Torts, and the Code of Procedure under Professor Chase. In the topics of Shipping and Insurance they have been instructed by Professor Dwight. They have also had under him a review of the Law of Contracts. They have been reviewed by Professor Lee in the Law of Real Estate. Professor Ordonaux has delivered his regular course of lectures in Medical Jurisprudence, and Professor Chase a course of voluntary lectures in Criminal Law.

The Junior class has studied under Professor Dwight the general outlines of Municipal Law, and more particularly the Law of Contracts, and under Professor Lee the Law of Real Estate.

Each class has been divided into two sections, so that the professor in charge has been obliged to conduct two exercises each day on the same subject.

The Moot Courts have been conducted with much spirit on the part of the students. These exercises are in a high degree beneficial, and contribute greatly to bridging over the distance between the work of the class-room and the business of professional life.

The number of students in the Senior class has been two hundred and forty-four; in the Junior class two hundred and forty-eight. The graduating class of 1888 numbered one hundred and fifty. Fifty-two literary colleges are represented among the students of this school.

Mr. Petty, who was appointed in the autumn of 1888 by the Trustees of the College an Instructor in Municipal Law, has instructed a division of the Senior class with marked success in the rules of common law Pleading and Practice. The Junior class has also been assigned to him for instruction in elementary law during the time that the examinations of the Senior class are proceeding.

A highly successful course of lectures on the law of Private Corporations has been conducted by Victor Morawetz, Esq., of the New York bar. The attendance upon his course has been excellent, and the results are very gratifying.

The courses of lectures by Professor Burgess on topics of Constitutional Law and Political Science have been regularly conducted with a good attendance of students.

The first-, second-, and third-prize tutorships, filled by the appointment of Mr. Paul D. Cravath, Mr. Alfred G. Reeves, and Mr. Philo P. Safford have proved highly useful, and have more than justified the expectations I entertained of their success in recommending the adoption of the tutorial system. They have been attended by the students in regularly increasing numbers. Mr. Reeves has instructed the students in the rules of Equity Pleading.

Respectfully submitted,

THEODORE W. DWIGHT,  
*Warden of the Law School.*

Columbia College, May 1, 1889.

DEPARTMENT OF HISTORY, PUBLIC LAW, AND POLITICAL  
SCIENCE.

*To the Acting President of Columbia College :*

In the department of History, Public Law, and Political Science in the School of Law, the Junior class have received three lectures per week, throughout the year, on the subject of Comparative Constitutional Law, and the Senior class two lectures per week, throughout the year, upon the History of Diplomacy and International Law.

Respectfully submitted,

JOHN W. BURGESS.

Columbia College, April 26, 1889.

## APPENDIX E.

### SCHOOL OF MEDICINE.

#### COLLEGE OF PHYSICIANS AND SURGEONS.

*To the Acting President of Columbia College :*

In behalf of the School of Medicine I have the honor to report as follows :

The number of matriculates for the calendar year 1888 was seven hundred and two (702), a diminution of one hundred and seven (107) as compared with 1887.

The reason for the diminution was a diminution both of applications and of admissions, owing to the establishment of an entrance examination in English, Latin, Arithmetic, and Algebra.

Of the seven hundred and two matriculates, 33 $\frac{7}{10}$  per cent. were, on matriculation, possessed of degrees, viz :

In medicine.....	38
In arts, philosophy, science, etc.....	199

Total.....	237
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In September, 1888, there were examined for the degree of M.D. twenty-eight (28) candidates ; of these eight (8) failed to pass, equal to 28 $\frac{1}{4}$  per cent.

The spring examinations of 1889 have not yet taken place.

In order that medical education might receive a fuller benefit from the vastly improved material conditions under which the College has been placed by the public spirit of its recent benefactors, the Trustees and Faculty resolved, a year ago, upon important changes in the length of the session, the amount and character of the obligatory studies, the requirements for graduation, and the fees for instruction.

Beginning with Commencement, 1888, the college year now consists of a period of vacation extending from Commencement to about the 1st of October, and of an annual session of between eight and nine months (as against between seven and eight in former years), extending from about October 1st to the following Commencement, which is held on or about the 15th of June. At the same time the absolute number of required didactic lectures is not increased. A greater number of hours each week are thus available for other exercises.

Beginning with the current session, the work required of the students of this College who are candidates for the degree of M.D. is distributed over three years of study, according to the curriculum set forth below.

Adhesion to this curriculum is, of course, not binding upon students who entered the College before the establishment of the same.

#### *Obligatory Exercises of the Regular Curriculum.*

##### FIRST YEAR.

Didactic Lectures in : 1, Anatomy ; 2, Physiology ; 3, Physics and Chemistry.  
Practical work in : 1, Dissection ; 2, Normal Histology ; 3, Physiological and Medical Chemistry.

## SECOND YEAR.

Didactic Lectures in : 1, Anatomy ; 2 Physiology ; 3, Physics and Chemistry ; 4, Materia Medica and Therapeutics, including Hygiene ; 5, Pathology and Practical Medicine ; 6, Principles and Practice of Surgery ; 7, Obstetrics and Gynecology.

Dissection.

Clinical Lectures at the Vanderbilt Clinic in : 1, General Medicine ; 2, General Surgery.

Practical Clinical Work in : 1, General Medicine ; 2, General Surgery.

## THIRD YEAR.

Didactic Lectures in : 1, Materia Medica and Therapeutics, including Hygiene ; 2, Pathology and Practical Medicine ; 3, Principles and Practice of Surgery ; 4, Obstetrics and Gynecology ; 5, Ophthalmology.

Clinical Lectures at the Vanderbilt Clinic in : 1, Diseases of the Mind and Nervous System ; 2, Gynecology ; 3, Diseases of Children ; 4, Genito-Urinary Diseases, including Syphilis ; 5, Diseases of the Skin ; 6, Diseases of the Throat ; 7, Diseases of the Eye ; 8, Diseases of the Ear.

Practical Clinical Work in the eight subjects enumerated immediately above under the head of "Clinical Lectures," and in Obstetrics.

Practical Work in Pathology and Pathological Histology.

For students of the new curriculum the requirements for graduation are as follows, viz :

I. *a.* Candidates who are not already graduates in medicine of recognized institutions must have pursued the regular three years' curriculum at this College, or the regular curriculum of the second and third years at this College, and such a course at some other medical school as shall have been recognized by the Faculty as an equivalent for the first year's curriculum at this College.

No course at another medical school will be recognized which shall have begun during the same calendar year as that in which the student who shall have attended it shall have entered this College.

*b.* Graduates in medicine of recognized institutions must have pursued at this College at least the regular curriculum of the third year.

II. All candidates, whether already graduates in medicine or not, must pass at this College examinations satisfactory to the Faculty in : 1, Anatomy ; 2, Physiology ; 3, Physics and Chemistry ; 4, Materia Medica and Therapeutics, including Hygiene ; 5, Pathology and Practical Medicine ; 6, Principles and Practice of Surgery ; 7, Obstetrics and Gynecology ; 8, Clinical Studies.

III. Candidates must present satisfactory evidence of good moral character and of having attained the age of twenty-one years.

IV. Candidates must have studied medicine thirty-six months under the direction of a regular practitioner or practitioners of medicine. The three years of medical study with a preceptor include the time spent in attendance upon medical schools, and must be exclusive of any time spent as an undergraduate at a non-medical institution ; but the course styled "Preparatory to the Study of Medicine," at the Cornell University, the Sheffield Scientific School of Yale College, the Johns Hopkins University, or the College of New Jersey, is accepted in place of six months' study with a preceptor, in the case of a student who afterwards attends three sessions at this College.

The professional examinations in all the eight branches are in writing, and are held immediately after the close of the lectures of the College year.

The examination in the topic of "Clinical Studies" comprises one question in each of the following subjects, set by the Clinical Professor thereof, viz : 1, Diseases of the Mind and Nervous System ; 2, Diseases of the Genito-Urinary Organs, including Syphilis ; 3, Diseases of Children ; 4, Diseases of the Eye ; 5, Diseases of the Ear ; 6, Diseases of the Throat ; 7, Diseases of the Skin.

With the exception of such graduates in Medicine as attend at this College only the third year of the curriculum, candidates, if they so elect, are eligible

for examination in any or all of the three branches of: 1, Anatomy; 2, Physiology; and 3, Physics and Chemistry, and upon these only, on completing the first two years of the curriculum.

Such an examination in any or all of the said three subjects, if satisfactory, is accounted final, unless the candidate subsequently is rejected for the degree of M.D., as set forth below.

A candidate who has been unsuccessful at the end of his second year, at any of the three examinations above specified, is not eligible for re-examination in the branch or branches in which he has failed until the time of his final examination for graduation. According to the merits of his examinations, three results of the latter are possible in the case of a candidate for the degree of M.D.

1. He is "passed" when his examinations have been satisfactory in each and all of the eight branches of medical teaching.

2. He is "conditioned" when the average merit of his eight examinations has been satisfactory, while in one or more branches he has been found deficient. In this case the candidate can proceed to his degree only on the condition that he first pass a re-examination in the deficient branch or branches not sooner than at the next regular examination. Candidates are not "conditioned," however, in the topic of "Clinical Studies."

3. He is "rejected" when the average merit of his eight examinations has been unsatisfactory. In this case the candidate must be re-examined in all the eight branches.

For the session of 1889-90, and thereafter, final examinations for the degree of M.D. will be held annually early in October, for the sole purpose of re-examining "rejected" or "conditioned" candidates, who, if successful at that time, will be advanced to their degrees at the November meeting of the Trustees.

A candidate who has been "rejected" twice or more for the degree of M.D. is thereafter eligible for re-examination only at the stated examinations held in the spring, and must pay a new matriculation fee between every two periods of re-examination.

It is believed that the establishment of entrance examinations and of the above improved curriculum constitute an important advance in medical education.

Very respectfully yours,

JOHN G. CURTIS, M.D.,  
*Secretary of the Faculty.*

Columbia College, May 6, 1889.

## APPENDIX F.

### REPORT ON THE LIBRARY.

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*To the Acting President of Columbia College :*

I have the honor to make the following statement from the library :

**The Staff.**—Very considerable changes in the working staff have been brought about during the year by the resignation of the Chief Librarian, the closing of the Library School, and the ensuing departure of a number of those who had been formerly on the pay-roll of the library.

These changes were more felt in the catalogue department, which has been reorganized with a much smaller number of persons, who devote their entire time to their legitimate duties. There are at present employed in the catalogue department seven persons, who have during the months since January 1st catalogued the current additions and made considerable progress on the arrears. It is probable, however, that for the coming year one or two more cataloguers will be needed to attend to the larger additions to be made from the increased appropriation which has been voted, and to make necessary changes in the cataloguing and arrangement of some parts of the library. Provision has been made in the appropriation for this need.

In the executive and reference departments the changes have been fewer, and it is believed that the somewhat reduced force will be able to meet all demands.

There have been added to the library during the twelve months of the fiscal year by purchase and exchange 6,378 volumes. Last year the additions from the same sources were 3,584 volumes. Additions from gifts of the same period were 2,124 volumes; last year, 1,395 volumes. Total additions of books, not including pamphlets, 8,502 volumes. Additions last year, 5,809. The number of pamphlets bought was 437; given, 1,405, beside 5,387 numbers of unbound periodicals given by the Editors of the *Popular Science Monthly*. Books or pamphlets were given by 516 different persons or institutions.

Of the character of the additions it may be said that a considerable number of extensive and costly sets of great scientific and literary interest has been added or completed in various departments. The titles of some of these are given below (under C). A monthly list of additions has been issued covering the accessions since October 1st, which is intended to give the officers and students a knowledge of the new books procured for the library.

Among the gifts are the interesting collection of books on Mary Queen of Scots, by Gen. J. W. DePeyster, and a collection of works on theology in the Dutch language, given by T. F. C. Demarest, of the class of 1864. Books have been bought on the direct recommendation or with the approval of the officers of the various departments to which the appropriation for books was assigned, and an account is kept with each officer. Their coöperation and interest in the growth and work of the library have been constant, and on their continued aid and counsel the extent and character of our collection will largely depend.



**Cataloguing.**—The work of cataloguing has been carried on under unfavorable circumstances. The presence of the Library School and the fact that nearly all of the staff of the cataloguers were connected with it, either as pupils or instructors, was not conducive to regular and profitable work, while the removal of the Library School created the necessity of organizing and putting into working order a new staff of cataloguers.

This has been done as far as practicable, but too short a time has passed since April 1st to bring it to a degree of efficiency which it will properly acquire. Certain changes, which were started in January, in the methods of work, and which have been gradually extended, were thought likely to facilitate the cataloguing, and the statistics of cataloguing work done give a favorable showing in confirmation. The number of cards written and corrected or revised during the year was 32,245, of which 19,846 have been done since January 1st. The number for the last year was 20,998.

On the departure of the former chief librarian a large number of recently purchased books were left uncatalogued, by actual count over 1,600 volumes, beside the collections given by Mr. Demarest and Gen. DePeyster. These, with the exception of the books from Mr. Demarest have been catalogued, together with the current additions. Several hundred books of the old library, which had never been finished, have been completed. A small part of the original library here in 1883 still remains to be catalogued.

**Use of the Library.**—The library has been open for the use of readers during the past year every secular day, with the exception of certain holidays, including one day of the Centennial week, April 30th.

The hours of opening the library in the morning were, in February, by the order of the Acting President, with the approval of the Library Committee, changed from 8 to 8:30. The number of persons inconvenienced by this change appears to be small.

While every facility for work in the library should at all times be provided for our students, it may be pertinent for the authorities of the College to inquire whether the interests of the officers and students of the various schools or the needs of those persons from the outside really engaged in serious study, require that the library be kept open during the evenings of the summer vacation months. I am not acquainted with any other important college library which is thus kept open, or whose directors intend or wish to thus extend the hour of opening.

The use of the library by students during the months of the college year is constant and regular. While statistics of the number of readers have as usual been kept, and are given below, no implicit reliance can be placed upon them as an indication from year to year of either the extent or character of the use made of the library. The librarians, who are in habitual intercourse with the patrons of the library, are better able to judge of the nature of the use made by readers. This use for the past year has been, on the whole, of good character, and the use of the library for purposes of real study and investigation increases with its growth in the material for such study.

The loans of books from the library do not vary materially in extent and character from those reported last year.

**Library Building.**—The additional table space provided last summer by the trustees is sufficient for the present needs of general readers. The book-cases on the main floor were covered over last summer, and the space thus obtained filled with tables. Beside the additional room thus gained giving excellent accommodation to forty (40) readers, the general appearance of the library has been improved by the additions. It will probably be advisable to cover these floors with linoleum or some similar substance to deaden the sound which now attends every movement on them. An additional rail has been put around both galleries, which not only improves the looks of the building, but conduces to the security of readers and library attendants.

The problem which demands the immediate attention of the trustees is that of providing additional room for the rapidly increasing volumes of the library.

With the present system of classification, or with any method of shelf arrangement which a librarian would be willing to use, the administration of the library is greatly embarrassed by the crowded condition of the shelves, making necessary frequent and laborious removals of whole classes of books from one part of the library to another. This reduces the advantage which readers get by access to the books themselves, and greatly hampers a prompt and sure service of books to readers on the part of the library attendants. An appropriation has been made to put additional shelving in the room commonly called number six, which, it is expected, will be put in place during the summer, and will give room for about 5,000 octavo volumes.

With this addition, and the utilization of all possible shelf-room in the old library building and elsewhere, it may be possible to put on the shelves all the books bought during the coming fiscal year, if no important or unusual gifts are received. The prospective transfer of the library of the late President Barnard, which is likely to take place early in the coming college year, is, however, just such an important gift.

If we shall succeed at great inconvenience in finding shelf-room for additions until July 1, 1890, that period will probably find the library literally without a shelf on which to put a new book. Immediate measures are thus necessary to provide a remedy for this condition, especially as any plan likely to be adopted will require in its execution a considerable time.

There is also pressing need of rooms for purposes of cataloguing and administration, and also for proper shelving and care of large and costly works, maps, etc., of which the library now owns many thousand dollars' worth. These valuable works are without proper receptacles, and have been damaged by moving and other causes.

Yale University is now putting up a new library building, of which the last President's report says :

"While the new building will have a capacity of about 200,000 volumes, and the new and old together 400,000, when all the space reserved for future extensions shall have been occupied, we have room for at least a million of volumes."

In Harvard University, Gore Hall, with its new addition, has present shelf-room for 400,000 volumes, with provision for enlargements according to present plans up to 650,000.

Cornell University is now putting up a new library building to hold "at least 470,000 volumes, with facilities for indefinite extension of the book stacks in the future."

Tables are appended showing the additions to and the monthly use of the library, together with a list of a few of the more important additions, and a list of the persons and institutions who have made gifts to the library during the year.

Respectfully submitted,

GEO. H. BAKER,  
*Librarian.*

Columbia College Library, June 29, 1889.

## A.

## ADDITIONS OF BOOKS, JULY 1, 1888, TO JUNE 30, 1889.

	July.	August.	September.	October.	November.	December.	January.	February.	March.	April.	May.	June.	
Bought . . . .	104	652	611	627	419	564	524	412	584	653	517	227	5,894
Exchanged . . . .	133	85	113	53	33	4	11	14	22	6	6	1	481
Given . . . . .	49	50	80	413	258	91	93	288	223	111	295	173	2,124
Total . . . .	286	787	804	1,093	710	659	628	714	829	770	818	401	8,499

## B.

## MONTHLY USE, 1888-89.

	Days Open.	Readers.	New Loans.	Renewals.	Total Loans.	Daily Average.	Largest.	Smallest.	Fines Received.	Readers' Tickets Issued.
July . . . .	26	1,108	427	220	647	24.9	28	3	\$4 45	3
August . . .	27	705	307	160	467	17.3	17	5	9 20	4
September . .	25	1,195	553	152	705	28.2	36	7	12 75	6
October . . .	27	7,463	1,167	530	1,697	62.8	75	26	31 40	17
November . .	26	6,092	1,389	214	1,603	61.6	88	11	21 40	23
December . .	25	4,400	852	636	1,588	59.5	54	3	24 35	14
January . . .	26	5,688	1,037	468	1,505	57.8	103	12	33 83	5
February . . .	24	7,624	1,147	533	1,680	70.0	69	18	22 60	6
March . . . .	26	8,503	1,405	884	2,289	88.0	65	35	26 00	18
April . . . .	24	6,695	1,242	1,677	2,919	121.6	72	13	30 10	8
May . . . . .	26	6,624	1,094	789	1,883	72.4	69	7	45 95	11
June . . . .	25	2,923	705	628	1,333	53.3	69	9	22 65	4
Total . . . .	307	59,020	11,325	6,891	18,316	59.3	—	—	\$284 68	119

## C.

## SOME IMPORTANT WORKS ADDED DURING THE YEAR.

Annales des sciences naturelles . . . . .	122 v.	Paris	1824-78
Annuaire de l'economie politique . . . . .	38 v.	Paris	1844-82
Annals and magazine of natural hist. . . . .	v. 59-78	Lond.	1867-76
Archivio storico Italiano . . . . .	81 v.	Firenze	1842-81
Athenaion . . . . .	18 v.	Athens	1872-81
Banker's magazine . . . . .	23 v.	Lond.	1844-62
Beiträge zur Geschichte d. deutschen Sprache . . . . .	10 v.	Halle	1874-85
Brandes. Skrifter. . . . .	20 v.	Copn.	1872-88
Bulletin de Soc. Belge de Microscopie . . . . .	12 v.	Brux.	1875-85
Bulletin des sciences mathématiques. . . . .	15 v.	Paris	1870-80
Camb. and Dublin mathematical journal . . . . .	9 v.	Camb.	1841-46
Camb. mathematical journal . . . . .	4 v.	Camb.	1841-46
Castlereagh. Memoirs and Correspondence . . . . .	12 v.	Lond.	1848-53
Chronicles and Memorials, publ. by Master of the Rolls . . . . .	56 v.	Lond.	1864-89
Classical Journal . . . . .	40 v.	Lond.	1810-29
Coutumes de la Belgique . . . . .	35 v.	Brux.	1869-84
Der Arbeiterfreund . . . . .	23 v.	Berlin	1864-85
Encyclopédie chimique. . . . .	48 v.	Paris	1884-88
Fornmanna Sögur . . . . .	12 v.	Copn.	1825-37
Fortschritte d. Physik. . . . .	20 v.	Ber.	1847-67
Great Britain. Correspondence on slave trade . . . . .	61 v.	Lond.	1824-71
Great Britain. Local gov. bd. Repts. of medical officer . . . . .	34 v.	Lond.	1858-87
Ibsen. Skrifter. . . . .	17 v.	Copn.	1874-89
Journal de mathématiques . . . . .	9 v.	Paris	1876-84
Kingsley. Works . . . . .	28 v.	Lond.	1880-88
Law journal . . . . .	162 v.	Lond.	1823-87
Marie. Hist. des sciences math. et physiques . . . . .	12 v.	Paris	1883-88
Maryland Hist. soc. Fund publications . . . . .	25 v.	Balt.	1867-88
Messenger of Mathematics . . . . .	16 v.	Lond.	1872-87
Michaud et Poujoulat. Mémoires . . . . .	34 v.	Paris	1854-57
Mittheilungen d. deutsch. Arch. Instituts . . . . .	8 v.	Athens	1876-83
Muratori. Antiquitates Italicae . . . . .	17 v.	Arretii	1773-78
Oxford, Camb. and Dublin Messenger of Math. . . . .	5 v.	Camb.	1862-71
Pertz. Monumenta Germ. hist. . . . .	55 v.	Hannover	1826-88
Polytechnisches Notizblatt. . . . .	28 v.	Mainz.	1846-70
Presidential election, 1876. Reports. . . . .	37 v.	Wash.	1876
Proceedings London Math. soc. . . . .	16 v.	Lond.	1865-84
Proudhon. Oeuvres complètes . . . . .	51 v.	Paris	1866-83
Prussia. Haus d. Abgeordneten, Stenographische Berichte . . . . .	81 v.	Ber.	1862-80
Prussia. Herrenhaus. Stenographische Berichte . . . . .	26 v.	Ber.	1862-80
Quarterly journal of pure and applied math. . . . .	16 v.	Lond.	1857-59
Recueil des trav. du comité d'hygiène . . . . .	17 v.	Paris	1872-88
Romania. . . . .	18 v.	Paris	1872-88
Samfund til udgivelse af gammel nordisk lit. . . . .	13 v.	Copn.	1880-86
Savage. Genealogical dict. . . . .	4 v.	Bost.	1860-62
Scripta Historica Islandorum . . . . .	12 v.	Copn.	1828-46
Serapeum. . . . .	32 v.	Lpz.	1840-70
Simonde de Sismondi. Hist. des republiques Ital. . . . .	16 v.	Paris	1826
Tooke. Hist. of Prices . . . . .	6 v.	Lond.	1838-57
Zeitschrift des Sächsischen statist. Bureau. . . . .	v. 1-30	Lpz.	1855-84

## D.

## GIFTS OF BOOKS AND PAMPHLETS.

JULY 1, 1888, TO JUNE 3, 1889.

	Vols.	Pam.		Vols.	Pam.
Aberdeen pub. lib. . . . .		1	Bodleian lib. . . . .	5	3
Acad. polytech. do Porto . . .	1		Bolton, H. Carrington . . .	1	79
Adams, Herbert B. . . . .		1	Bookmart . . . . .	1	
Alabama Auditor . . . . .	8		Booth, Mrs. A. Howe . . .		1
" Bar assoc. . . . .	4	1	Bost. Board of health . . .	2	
" R. R. com. . . . .	2	1	" City council . . . . .	3	1
Albany Com. council . . . . .	1		" Park com. . . . .	1	
Allegheny " . . . . .	9		" Public lib. . . . .	1	2
Am. Bar assoc. . . . .	1		" Record com. . . . .	3	
Am. Congregational assoc. . .		27	" Water board . . . . .	1	
Am. Ephemeris . . . . .	1		Bowdoin coll. . . . .		2
Am. Geog. soc. . . . .	1		Boyesen, Prof. H. H. . . .	2	
Am. Inst. mining eng. . . . .	1		Bradlee, C. D. . . . .	1	
Am. Metrological soc. . . . .	15	17	Bradstreets . . . . .	1	
Am. Museum of nat. hist. . .	1	4	British Horological Inst. . .	4	
Am. soc. of mechan. eng. . .	3		Britton, Dr. N. L. . . . .	60	5
Amherst college . . . . .		2	Bronson lib. . . . .		1
Amsterdam Bibliotheek . . .	2		Brookline Pub. lib. . . . .	1	1
Andover Theol. sem. . . . .	1		" Town officers . . . . .	1	
Anthony, E., H. T. & co. . . .		12	Brooklyn Comptroller . . .	6	
Appleton, D. & co. . . . .	2		" lib. . . . .		2
Arms Academy . . . . .		1	" Polytechnic inst. . . .		1
Astor library . . . . .	1	1	" Supt. of pub. . . . .		
Atlanta Univ. . . . .		1	instr. . . . .		1
Auburn (N. Y.) Com. . . . .			Brown, J. Crosby . . . . .	3	22
council . . . . .		2	Brown Univ. . . . .		3
Augusta (Me.) Mayor . . . .		4	Bryn Mawr coll. . . . .		3
Ayer Mfg. Co. . . . .	1		Buff & Berger . . . . .		2
Babcock & Wilcox Co. . . . .	1		Buffalo Hist. soc. . . . .		3
Bain, A. & Co. . . . .		1	California Board of equali- . .		
Baker, G. H. . . . .	4	1	zation . . . . .		2
Baker, W. G. . . . .	10		California Comptroller . . .	5	
Balt. Coll. of dental sur. . .		2	" Labor bur. . . . .	1	
Balt. Mercantile lib. assoc. .		1	" Mineralogist . . . . .	1	
Bangor (Me.) Mayor . . . . .	10		" R. R. com. . . . .	5	
Bangor (Me.) pub. lib. . . .		2	" Univ. . . . .	1	6
Bangs & Co. . . . .	1		Cambridge (Mass.) Mayor . .	7	
Barlow, S. L. M. . . . .	1		" Pub. lib. . . . .		6
Barnard, F. A. P. . . . .	26	125	Canada Dept. of agric. . . .	2	
Barnes, A. S. . . . .		1	" Geol. & nat. hist. . .		
Bartram, F. S. . . . .	1		sur. . . . .	1	
Bay City Com. council . . . .	1		Canada Royal soc. . . . .	1	
Beer, William . . . . .	1		Carleton coll. . . . .		2
Bell, Alex. M. . . . .		1	Carpenter, Dr. W. H. . . .	7	
Benton, J. H. jr. . . . .	1		Centennial Committee . . .		4
Birchard lib. . . . .		1	Chambers-Ketcham, Mrs. . .		
Birmingham (Eng.) Free . .			A. . . . .	2	
lib. . . . .	2	2	Chandler, Prof. C. F. . . .	24	

	Vols.	Pam.		Vols.	Pam.
Chicago Board of trade . . . . .	5		Eliot, W. G. . . . .		2
" Law institute . . . . .	1		Emory coll. . . . .		1
" Photo-Gravure . . . . .			Enoch Pratt Free lib. . . . .		2
co. . . . .		1	Erickson, E. N. . . . .	1	
Chicago Pub. lib. . . . .		2	Fisk, Harvey E. . . . .	86	
Cincinnati Pub. lib. . . . .	1		Fitchburg Com. council . . . . .	16	
" Soc. nat. hist. . . . .	1		Fletcher Free lib. . . . .		1
" Univ. . . . .		1	Foster, Roger . . . . .	1	
Cleveland Acad. nat. sci. . . . .	1		Franklin & Marshall coll. . . . .		1
" Auditor . . . . .	3		Frothingham, E. L. . . . .	1	
Clinton (Mass.) Town of- ficers . . . . .		1	Gaviller, A. . . . .		2
Cole, Capt. Jas. E. . . . .		8	Georgia Comptroller . . . . .	7	
Colorado Labor bur. . . . .	1		" Univ. . . . .		1
Columbia coll. Miner ed. . . . .	2	1	Gerry, Elbridge T. . . . .	1	
Columbia " Spectator ed. . . . .	3		Gloucester (Mass.) . . . . .	15	
Concord (N. H.) Com. council . . . . .	1		Goldschmidt, S. A. . . . .	1	
Conn. Acad. of arts & sci. . . . .	1		Gottheil, Prof. R. J. H. . . . .	2	1
" Board of health . . . . .	8		Grand Rapids Board of trade . . . . .		1
" Comptroller . . . . .	3	2	Green, S. A. . . . .		6
" Insurance com. . . . .	4		" S. S. . . . .		4
" Labor bur. . . . .	2		Grubb, Sir Howard . . . . .		5
Conn. R. R. com. . . . .	1		Gudeman, A. . . . .	1	
Cornell Univ. . . . .		2	Gustavus Adolphus coll. . . . .		1
Cornwall Mining assoc. . . . .	1		Hackett, Frank W. . . . .	1	
Cox, C. F. . . . .	3		Halliwell-Phillipps, J. O. . . . .	6	
Crane, Rev. Oliver . . . . .	1		Harlem lib. . . . .	1	
Croes, J. J. R. . . . .	1		Harris, A. . . . .		1
Crosby, Ernest H. . . . .	7		" G. . . . .	1	
Cutler, M. S. . . . .	1	2	Harrisburg City compt. . . . .		1
Daily Register . . . . .	3		Hartford Lib. assoc. . . . .		1
Dakota Auditor . . . . .	3	1	" Theol. sem. . . . .		1
Dartmouth coll. . . . .		1	" Young men's inst. . . . .	1	
Daubree, A. . . . .	3		Harvard coll. . . . .	3	3
Davis, R. C. . . . .		3	" obser. . . . .		3
Delta Kappa Epsilon soc . . . . .	1		Haverford coll. . . . .		1
Delta Epsilon soc. . . . .	2		Haverhill Pub. lib. . . . .	1	
Demarest, Theo. F. C. . . . .	152		Heckroth, George. . . . .		2
De Peyster, Gen. J. Watts . . . . .	267	22	Heller & Brightly . . . . .	1	2
Detroit Comptroller . . . . .	1		Helper, Hinton R. . . . .	1	
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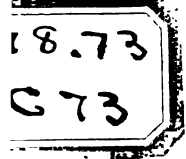


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*R. C. Davis*  
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**Columbia College**  
**in the City of New York**

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**PRESIDENT'S**  
**ANNUAL REPORT**

1890





**Columbia College**  
**in the City of New York**

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**ANNUAL REPORT**

**OF**

**PRESIDENT LOW**

**TO THE**

**TRUSTEES**

**OCTOBER 6, 1890**

**NEW YORK**  
**PRINTED FOR THE COLLEGE**  
**NOVEMBER, 1890**

11-29-'90-6500



*To the Trustees of Columbia College in the City of  
New York :*

In accordance with the statutes I have the honor to submit herewith the president's report for the academic year ending June 30, 1890.

At the meeting of the trustees, held October 7, 1889, the vacancy in the office of president caused by the death of Dr. Barnard was filled by the election of the undersigned. By mutual agreement the ceremony of installation took place on Monday morning, February 3, 1890, in the Metropolitan Opera House, and the actual discharge of the duties of the office began on Thursday, February 6, 1890, the first day of the second term.

During the first term of the academic year, therefore, the institution was administered, as it had been during the whole of the previous year, by the acting president, Dr. Drisler. The trustees know how intelligently and with what fidelity, characteristic of the man, the delicate duties of this difficult and trying period were discharged. More than one stumbling-block during this interval was chivalrously removed by the acting president, so that the path of the incoming president might be the easier to tread. To all the demands for assistance which it was inevitable that the new-comer must make upon the

experience which had guided the college for more than a year and a half, the response of Dr. Drisler was prompt and generous, and it is no less a pleasure than a duty to make this acknowledgment of my manifold indebtedness to him for willing and constant help.

Before submitting the usual statistics concerning the various schools it would seem to be judicious to give a general survey of the institution as a whole, as I found it upon assuming the duties of the president's office. This is the more desirable, as it will help to make clear the significance of the steps already taken, in the hope of increasing our usefulness in the future.

On the 6th of February, 1890, Columbia College in the City of New York consisted of the School of Arts, or the college proper, founded in 1754; the School of Law, established in 1858; the School of Mines, established in 1864; and the School of Political Science, established in 1880. In addition to these schools, which are under the direct control of the trustees of the college, the College of Physicians and Surgeons had become in 1860, by joint resolution of its own board of trustees and the trustees of Columbia, the Medical Department of Columbia College. The president, however, and this board, have no responsibility as towards the medical department, and this report, therefore, will concern itself at this point with the other schools only.

Each of these schools, the School of Arts, the School of Law, the School of Mines, and the School of Political Science, had its own faculty, and each school was administered without any reference to the others, almost without any consciousness of the others. There were indeed students of one school

taking some studies in one or another of the other schools, but in order to make such a combination of studies the student was obliged to matriculate in each school in which he studied and to pay in each school the matriculation fee of five dollars. No degree could be had except by pursuing the complete course in some one school. Seniors in the School of Arts were permitted to elect certain subjects in the School of Mines and the School of Political Science. Admission to the School of Arts, the School of Law, and the School of Mines, was based upon requirements laid down by the faculty in each case. Admission to the School of Political Science was open only to those who had completed the undergraduate course to the end of the junior year in Columbia College or in some other college maintaining an equivalent curriculum. Graduate work was carried on by the individual professors of the School of Arts both in letters and science, and also by the professors of the School of Mines in science, while all the work of the School of Political Science after its first year was graduate work, except so far as it received non-graduate members of the Law School for certain courses. In other words, the attitude of the institution towards the student was one of multiplied opportunities, but opportunities held more or less out of relation to each other. What seemed especially to be needed, from the point of view of the student, was such a unification of the institution as would make its varied opportunities more available to those students whose equipment and capabilities justified them in desiring to study in more than one school.

As towards the trustees, also, the existing situation

had developed embarrassments. All of the scientific professors in the faculty of the School of Arts had seats also in the faculty of the School of Mines. In another instance, one professor sat in the three faculties of arts, law, and political science. When, therefore the judgment of the teaching faculties of the entire institution was sought by the trustees, it had become necessary to direct that no professor should vote in more than one faculty. It was clear to all concerned that some body ought to be constituted which should represent to the trustees the teaching mind of the institution in all its parts. The problem was to secure a body which would be accepted as fairly representative by all the members of every faculty.

Again, the graduate work, for which were given the higher degrees of master of arts and doctor of philosophy, stood in need of organization. It had grown to considerable proportions, but for the most part it depended too much upon individual professors. There was no general standard to which all must conform. In the School of Political Science, it is true, this work represented a large part of the labors of the faculty, for, with the exception of the first year, it is a graduate school ; but in the School of Arts and the School of Mines the graduate work was a mere incident. For this purpose, also, it was necessary to secure a body which could, in effect, direct the graduate work where it concerned itself with more than one school, and provide a common standard for all the schools. Incidentally, it was desirable, if possible, to place this work in its general phases, under the charge of faculties rather than of individuals.

It thus appears from these different points of view

that the first thing necessary in any reorganization was to secure the central body which would unify the institution in the various directions indicated, thus enabling it to be operated as one whole instead of as so many parts. The one essential condition in relation to such a body was that it should be felt to be, and be accepted by both trustees and professors as thoroughly and fairly representative of the entire institution. Prior to my election the trustees had in fact decided that there should be such a body, to be known as an academic or university council. When I assumed the duties of my office, it remained to be decided how this body should be composed, and what precisely should be its function. It was the common opinion, also, that there should be created a faculty of philosophy, to have charge of the advanced work in philosophy, philology, and letters. Such a faculty, if created, made it possible to divide all the professors in the institution into homogeneous groups, of which groups no professor should be in more than one. It was manifest that a foundation for the university council would thus be had, better than the existing faculties, in which so many of the professors sat in two or more. A difference of opinion apparently existed as to the scope of this proposed faculty of philosophy. Happily the difference proved to be only apparent. Various plans had been suggested at different times to meet the many difficulties of the situation, but none had been able to command universal assent. The plan actually adopted was the outcome of a series of discussions in which all the professors of the institution took part. Happily it has met with the cheerful approval and acceptance of every one.

Under this plan the University Council is based primarily on the four University Faculties of Law, Mines, Political Science, and Philosophy, which between them comprise all the professors entitled to a seat in any faculty, and yet no professor sits in more than one of them. It seemed to be essential that the representation of all university faculties should be equal : first, so that the university as such should not appear to emphasize one branch of learning as more important than another ; second, in order to prevent jealousy as to the growth of this or that faculty in the future ; third, in order to determine without controversy the basis upon which any new university faculty should be represented. The university council, therefore, is based primarily upon a representation of two from each of the university faculties. But when this had been decided upon there remained still this difficulty. The faculties of mines and of philosophy, speaking broadly, were as large as the faculties of law and political science put together. It had even been suggested that these last two faculties should be amalgamated, thus securing three university faculties as the basis of the council, instead of four, but all of which should be of nearly equal size. This question was thoroughly discussed, and both the faculty of law and the faculty of political science presented such cogent reasons for the division actually existing as to convert a large majority of those who had been inclined to favor the merger. It became necessary, therefore, to find some other way in which to equalize the representation in the university council at the moment of reorganization, so as to command the confidence and

hearty co-operation of all. In view of the historic relations of the School of Arts to the other schools, and to attain this end, it was determined to give to that school, as a school, an ex-officio representation of two. But the trustees will note that it is not the faculty of the School of Arts which is so represented, but the school as such. All the members of the faculty of the School of Arts are already represented through the different university faculties. Further, in the course of the discussions it had been made evident that in the first instance it would be wise to give to the university council advisory powers only, and that it should be especially a body advisory to the president. Accordingly, it appeared reasonable also that the president should be charged with the duty of selecting two additional members of the council in such a way as to secure an even representation of subjects. Thus the university council was made to consist of twelve members, four of whom, as matter of fact, are men of letters, four of whom are men of science, and four of whom are men of law and political science. There seems to be here a university council so framed as to admit of the modifications which time will bring without friction or serious embarrassment. Meanwhile it may be said that the composition of the council in its personnel has proved to be such as to command just what was desired, the confidence and the hearty co-operation of all. I have already found it an instrumentality of the greatest value, and I am sure that to the trustees also it will prove itself of the utmost usefulness.

With such a university council at hand representing all interests, it was found easy to secure the de-

sired relation between the faculties in their attitude towards the students. It was decided that every student should matriculate simply as a student of Columbia, paying but the one matriculation fee, and thereafter that the facilities offered by any faculty or by all should be open to him, subject, of course, to any necessary regulations. Thus at one stroke Columbia ceased to be divided into fragments, and took upon herself the aspect of a university, wherein each department was related to every other, and every one strengthened all.

Similarly, the general control of graduate work passed in effect into the hands of the university council. The result has been to secure a common basis of requirement for the degrees of master of arts and doctor of philosophy, under whatever university faculty they may be obtained, which common basis represents a combination, for the most part, of the best requirements hitherto maintained in any quarter. Graduate work, also, has been defined by the trustees to be university work. There is much more in this definition than a mere change of name. Graduate work may be conducted as a mere incident of undergraduate work, but university work makes the undergraduate work incidental to itself. The college is indeed the seed out of which has grown our university, but the tree, which is the university, does not exist for the sake of the seed, but the seed for the sake of the tree. Columbia, in effect, by these recent changes has made it clear that whatever else she may be or do, she proposes to offer to New York and to the country, hereafter, the privileges of such a university as the great city will enable her to become and



be. There is no field of intellectual interest which does not now become to her a part of her concern. So long as there is any branch of human learning in which her facilities are not the best, her facilities will stand in need of improvement. So long as there is any domain of knowledge in which she is not at work, the call to her to be up and doing may not pass unheeded. The one condition upon which Columbia may be to New York the university of the city's love and pride, is that Columbia shall show herself worthy. Her ideal must be high, her scope comprehensive, and her work substantial. She ought to have no less an aim than to give a distinctly intellectual tone to life in the great city. She may well continue to do what she has been doing. Undergraduate preparation and professional training are no less necessary and no less honorable than they always have been. But Columbia may well aim to add to these such a study of all subjects as is characteristic of the most advanced universities. It ought to be a distinct part of her aim to contribute something every year, by way of original work, to the sum of human knowledge. A great students' library and ample laboratories are an essential equipment for such a service. Happily our library is already comprehensive enough to be highly useful, and every year adds to its efficiency. In many directions, no doubt, we shall find increased laboratory facilities to be necessary. These will come, I am confident, when we are ready for them.

But, after all, a university is made great by its men. We are fortunate as a whole in our existing staff. There is no duty which will devolve upon the trustees more critical than the selection of new men as

that may be from time to time necessary. I am persuaded that no academic call in the country is more attractive than a call to Columbia, situated as she is in the city of New York. This will be increasingly the case as she comes to be thought of as fittingly embodying New York's just aspirations for a great university. Except in those cases where local conditions indicate the proper incumbent of a chair, the only man to be thought of is the best man in the world, if we know where to find him. Not the least advantage of our recent reorganization is, that we now have abundant use for men as professors to whom before we could assign no duty, because there was no opportunity for them, either in the college proper or the professional schools. Another consequence flows from the same source. For such of our staff as show themselves competent for university work, we must secure the time in which to make researches themselves and to lead others in research. We must not use up all the powers of such men in pedagogic work. A great university must not content itself with teaching only what is already known. It must feel itself bereft of half its glory unless it continually makes additions to existing knowledge. This is one of the great distinctions between a college and a university. Meanwhile, for us in New York, the way to make our college great is to make our university great. By common consent we have advantages second to none in the country for university work proper. The college proper is certain to feel by reflex action the advantages of a university that is famous.

The most important result of the reorganization of the institution thus far attained in its bearing upon the

college proper, is seen in the enlarged option already given to the members of the senior class. By a unanimous vote of the faculty of the School of Arts, it was resolved that courses under any university faculty designated by such faculty as open to seniors, should be accepted as optional courses for seniors in the School of Arts. This action, being referred by the trustees to the president and university council, with power, was unanimously endorsed by them. The senior year is thus made the point of contact between the college and the university. This arrangement, while it has the advantage of maintaining the dignity of the faculty of the college proper as a degree-granting faculty, has the other undoubted advantage of making the bachelor's degree seem, not so much the end of a student's course, as what it ought to be, merely an incident on the way to the true goal, the professional degree, or the degree of doctor of philosophy. While it in no way cheapens the bachelor's degree, it does shorten by one year the time required for the college and professional course combined.

One of the most interesting incidents of the year just closed was the fact that for the first time the commencement exercises included the College of Physicians and Surgeons as the medical department of Columbia, as well as the other departments of the university. Owing to the lengthening of the Law School course from two to three years, the Law School had no graduating class. This incident of the joint commencement, resulting as it did from approaches on the part of the College of Physicians and Surgeons, may well suggest an inquiry as to whether the time has not come for a more vital connection

between the two institutions. The change in the character of the commencement occasion brought about in this way necessitated considerable changes in the conduct of the exercises. The Class of '90 in the School of Arts and the School of Mines were obliged to forego the privilege of speaking, which other classes had uniformly enjoyed. The pressure on the house also for the accommodation of the friends of so many students was very severe; and all had to be content with an allowance of seats much smaller than usual. I am gratified to report that the Class of '90 submitted to these restrictions, although they bore upon them with a hardship which could not be denied, with a loyalty that was complete. No other class will feel the change in quite the same way.

The public lectures maintained by the college have been a prominent feature of the work of Columbia of late years. The usual series of Saturday morning lectures were given in the Law School lecture-room, beginning November 16, 1889, and extending to May 30, 1890. The attendance upon these lectures showed an unabated appreciation of their benefits. Besides these usual lectures, the college offered to the public, during 1889-90, the following special courses:

A course of six lectures on Egypt by Miss Amelia B. Edwards, the honorary secretary of the Egyptian Exploration Fund. These lectures were delivered in the hall of the Cooper Union, and were attended every evening to the full capacity of that large hall.

A course of seven lectures on "Art for Art's Sake," delivered at the college by Dr. John C. Van Dyke of Rutgers College.

A course of seven lectures on "Mediaeval Literature," by Prof. Charles Sprague Smith of Columbia College.

In conformity with the practice of recent years, and at the request of the students, Lenten addresses were delivered in the chapel by

Rev. Phillips Brooks, D.D.,  
 Rev. George R. Van De Water, D.D.,  
 Rev. Lyman Abbott, D.D.,  
 Rev. C. H. Parkhurst, D.D.,  
 Rev. Richard D. Harlan,  
 Rt. Rev. H. C. Potter, D.D.

The growth of the library during the year has been unusual. By purchase or exchange it has acquired 11,098 bound volumes and 1,352 pamphlets, and by gift it has received 3,027 bound volumes and 1,355 pamphlets. It has been kept open 305 days during the year from 8:30 A.M. to 10 P.M., and the total number of readers has been 46,033, an average of 150 a day. The total number of new loans during the year was 16,004, and of renewals 9,463, showing an average of  $83\frac{1}{2}$  loans during each open day. The loans indicate the number of volumes withdrawn from the library to be used elsewhere. The character and number of the borrowers are indicated by the following table:

BORROWERS FROM JULY 1, 1889, TO JULY 1, 1890.

		Arts.	Mines.	Law.	Barnard.	Total.
Officers and Employees .....	178					178
Graduates .....		123	92	168		383
Students .....		270	180	242	11	703
Totals .....	178	393	272	410	11	1,264

It is apparent, therefore, that the liberal policy of the trustees towards the library is bearing rich fruit. It is gratifying to report that, in accordance with the order of the trustees, the college was able to show its sympathy with the University of Toronto in the destruction of their library by fire, through the gift of 1,613 duplicates, selected by their librarian as valuable to them, while as duplicates they were of comparatively little worth to us. There is no mark of a university more characteristic than its library and the use that is made of it. Happily there is no direction in which Columbia, of late years, has made more significant strides.

The following statistics concerning the students of Columbia at the present time will be found interesting :

Undergraduates .....	269
Graduates.....	563 less 48 dupl..... 515
Non-graduate professional students, 911 " 34 " ....	877
	<hr/> 1,661
Columbia College Course for Women (now superseded by Barnard College).....	10
	<hr/> 1,671

The details are as follows :

	Men already having the degree of A.B. or other collegiate degree.	Men already having the degree of C.E. or other scientific degree.	
Arts.....	33.....	2	35
Law.....	186.....	26	212
Mines.....	25.....	23	48
Political Science...	47.....	6	53
Medical College....	141 ; Ph.G., 18 ; M.D., 34 ; 22		215
			<hr/> 563

	Men without degree studying for techni- cal and professional degrees.	Collegiate Course for Women (now su- perseded by Bar- nard College).
Law.....	244	10
Mines.....	218	
Medical College.....	404	
Political Science.....	45	
	<hr/> 911	

To speak as to the graduate students in the terminology of our reorganization, there are studying under the

University Faculty of Law.....	212
“ “ “ Mines.....	56
“ “ “ Political Science.....	53
“ “ “ Philosophy ..	27
	<hr/> 348
Less duplicates.....	48
	<hr/> 300

It is clear from the foregoing figures that the number of students preparing themselves for professional work without previous college training is very formidable. As bearing upon this general question, however, the following tables are submitted, showing year by year the proportion of college-bred men who have entered the Law School and the School of Mines, from the date of the establishment of those schools, and the College of Physicians and Surgeons since 1860. These figures show that the last decade in the first two schools indicates an improvement in the percentage of college-bred men as compared with the preceding decade. Compared with the earlier years of both schools there is a falling off. On the other hand a graduate department has been developed at

Columbia since 1880, in addition to the professional schools, in which during the last year there have been seventy men. It would appear, therefore, to be the testimony of Columbia's experience that a larger number of men than ever before are considering the studies which lead to their first degree, as preparatory only to more advanced study. The disposition to take the professional degree without a previous college training certainly has not increased in the last ten years, as witnessed by these two typical and important schools of Law and Mines. In the Medical School the percentage is singularly constant.



## SCHOOL OF LAW.

Year.	Total number of students entering.	Number holding degree on matriculation.	Percentage of students holding degree on matriculation.
1858	36	17	47 per cent.
1859	26	15	58 " "
1860	61	33	54 " "
1861	79	44	56 " "
1862	90	44	49 " "
1863	99	51	52 " "
1864	77	40	52 " "
1865	117	54	46 " "
1866	76	44	58 " "
1867	108	58	54 " "
1868	107	42	39 " "
1869	135	68	50 " "
1870	124	43	35 " "
1871	167	68	41 " "
1872	209	84	40 " "
1873	240	93	39 " "
1874	291	119	41 " "
1875	322	103	32 " "
1876	224	120	54 " "
1877	237	100	42 " "
1878	227	115	51 " "
1879	212	101	48 " "
1880	254	109	43 " "
1881	232	105	46 " "
1882	188	87	46 " "
1883	196	100	51 " "
1884	180	88	43 " "
1885	199	83	42 " "
1886	236	98	41 " "
1887	257	101	39 " "
1888	205	101	49 " "
1889	251	111	44 " "

*Average, by decades, of students holding degrees on matriculation.*

1858-70.....	51 per cent.
1870-80.....	42 " "
1880-90.....	44 " "

Until July, 1882, a degree from the Law School secured admission to the bar without examination.

## SCHOOL OF MINES.

Year.	Total number of students seeking degrees.	Number holding degree on matriculation.	Percentage of students holding degree on matriculation.
1864	27	7	26 per cent.
1865	29	12	41 " "
1866	26	11	42 " "
1867	23	6	26 " "
1868	22	6	27 " "
1869	16	1	6 " "
1870	25	1	4 " "
1871	32	0	0 " "
1872	62	8	10 " "
1873	76	11	15 " "
1874	84	11	13 " "
1875	72	10	14 " "
1876	73	2	3 " "
1877	84	4	5 " "
1878	80	3	4 " "
1879	86	6	7 " "
1880	93	3	3 " "
1881	109	17	16 " "
1882	84	4	5 " "
1883	90	8	9 " "
1884	90	5	6 " "
1885	70	1	1 " "
1886	93	10	12 " "
1887	64	9	14 " "
1888	88	13	17 " "
1889	77	14	18 " "

*Average, by decades, of students holding degrees on matriculation.*

1864-70.....	28 per cent.
1870-80.....	8 " "
1880-90.....	10 " "

Since 1885 there have been 36 men connected with the school in the graduate department and summer schools, 23 holding degrees, who are not included in the above statement.

Previous to the year 1879-80 there had been 390 special students, 64 of whom held degrees.

COLLEGE OF PHYSICIANS AND SURGEONS,  
MEDICAL DEPARTMENT OF COLUMBIA  
COLLEGE.

Year.	Total number of students entering.	Number holding degree on matriculation.	Percentage of students holding degree on matriculation.
1860	208	55	22 per cent.
1861	264	61	23 " "
1862	223	62	28 " "
1863	254	75	30 " "
1864	288	99	34 " "
1865	300	105	35 " "
1866	465	204	44 " "
1867	344	137	40 " "
1868	319	136	43 " "
1869	309	116	38 " "
1870	338	151	44 " "
1871	325	137	42 " "
1872	332	123	37 " "
1873	369	128	35 " "
1874	387	127	33 " "
1875	452	170	38 " "
1876	410	152	37 " "
1877	439	176	40 " "
1878	413	142	34 " "
1879	485	179	37 " "
1880	513	187	36 " "
1881	555	195	35 " "
1882	547	201	37 " "
1883	543	192	35 " "
1884	505	184	36 " "
1885	490	189	39 " "
1886	502	177	35 " "
1887	606	188	31 " "
1888	809	237	29 " "
1889	701	247	35 " "
1890	619	223	36 " "

*Average, by decades, of students holding degrees on matriculation.*

1860-70.....	36 per cent.
1870-80.....	37 " "
1880-90.....	35 " "

The following usual statistics are submitted for purposes of comparison :

### SCHOOL OF ARTS.

*Attendance during last five years.*

	1885-86.	1886-87.	1887-88.	1888-89.	1889-90.
Seniors.....	60	52	48	36	45
Juniors.....	57	51	44	50	56
Sophomores ....	60	58	63	69	66
Freshmen .....	70	76	78	82	102
	247	237	233	237	269

*Ages of undergraduates, 1889-90.*

Class.	No. in Class.	Average Age.	Oldest.	Youngest.
Senior.....	45	20 $\frac{4}{18}$	22	18
Junior.....	56	19 $\frac{1}{18}$	23	16
Sophomore .....	66	18 $\frac{11}{18}$	23	16
Freshman.....	102	17 $\frac{11}{18}$	27	15

*Elective and required Studies.*

#### STUDIES ELECTIVE BY SENIORS ONLY.

Number in class.....	45
English .....	14
Astronomy .....	27
Philosophy .....	16
Ethics .....	11
Chemistry .....	21
Political Economy.....	25
Constitutional History of Europe.....	20
“ “ “ England.....	18
Geology.....	14
Anglo-Saxon.....	9
Practical Astronomy.....	4
Hebrew.....	3
Sanskrit.....	2
Danish.....	1

## STUDIES ELECTIVE BY BOTH JUNIORS AND SENIORS.

	Seniors.	Juniors.	Total.
Number in class.....	45	56	101
Greek.....	7	5*	12
Latin.....	13	6*	19
Mathematics.....	6	14	20
Physics.....	13	39	52
Botany.....	11	9	20
French.....	13	20	33
German.....	12	20	32
Spanish.....	6	10	16
Italian.....	2	1	3

\* In the junior class, Latin and Greek are required for two hours per week each throughout the year ; the figures show the number who have chosen one hour additional in each of these languages.

## MODERN LANGUAGES ELECTIVE BY SOPHOMORES AND FRESHMEN.

	Sophomores.	Freshmen.	Total.
Number in class.....	66	102	168
French.....	38	59	97
German.....	23	37	60
Italian.....	4	2	6
Spanish.....	6	5	11
Special, electing none.....	3	5	8

## TOTAL NUMBER IN ALL THE CLASSES ELECTING MODERN LANGUAGES.

Total number of students.....	269
Number electing French.....	130
“ “ German.....	92
“ “ Spanish.....	27
“ “ Italian.....	9

## SCHOOL OF LAW.

*Attendance during last five years.*

	1885-86.	1886-87.	1887-88.	1888-89.	1889-90.
Seniors.....	146	164	207	244	—
Middle Class....	—	—	—	—	205
Juniors.....	198	245	274	248	251
	344	409	481	492	456

## SCHOOL OF MINES.

*Attendance during last five years on regular courses.*

	1885-86.	1886-87.	1887-88.	1888-89.	1889-90.
Fourth Class....	34	53	42	54	54
Third " ...	56	50	54	51	33
Second " ...	73	73	73	50	69
First " ...	73	88	59	74	75
	236	264	228	229	231

*Distribution of courses in 1889-90 including post-graduates.*

	1st class.	2d class.	3d class.	4th class.	P. G. courses.	Total.
Mining Engineering.....	16	10	5	7	—	38
Civil Engineering.....	22	26	12	18	—	78
Metallurgy .....	—	—	1	6	—	7
Analytical and App. Chemistry.	11	12	5	6	—	34
Geology and Palæontology....	1	1	—	—	—	2
Architecture .....	24	20	10	17	5	76
Sanitary Engineering.....	1	—	—	—	—	1
Electrical Engineering .....	—	—	—	—	19	19
Doctor of Philosophy.....	—	—	—	—	11	11
Total.....	75	69	33	54	35	266

## SCHOOL OF POLITICAL SCIENCE.

*Attendance during last five years.*

	1885-86.	1886-87.	1887-88.	1888-89.	1889-90.
No. of students (not classified).....	73	71	62	69	98

## GRADUATE DEPARTMENT OF THE SCHOOL OF ARTS AND THE SCHOOL OF MINES.

By the reorganization of this year merged in the work of the University Faculties.

*Attendance during last five years.*

	1885-86.	1886-87.	1887-88.	1888-89.	1889-90.
School of Arts.....	20	26	36	28	35
School of Mines .....	4	6	7	9	35
	<u>24</u>	<u>32</u>	<u>43</u>	<u>37</u>	<u>70</u>

## COLLEGIATE COURSE FOR WOMEN,

Superseded in 1889 by Barnard College.

	1885-86.	1886-87.	1887-88.	1888-89.	1889-90.
No. of students (not classified).....	13	20	28	25	10

## MEDICAL DEPARTMENT.

*Attendance during last five years.*

	1885-86.	1886-87.	1887-88.	1888-89.	1889-90.
No. of students (not classified).....	502	606	809	702	619

In 1888-89 an entrance examination was established in English, Latin, arithmetic, and algebra, and the course was lengthened to three years.

The residences of students are as follows. The title New York State is exclusive of the city specified :

Residence.	School of Arts.	School of Mines.	School of Political Science.	School of Law.	School of Medicine.	Graduate Department.	Course for Women.	Total.
New York City .....	138	101	67	207	207	35	4	759
Brooklyn .....	35	34	12	54	47	15	4	201
Alabama .....		2			1			3
Arkansas .....				1	2			3
California .....				3	2			5
Colorado .....				2	1			3
Connecticut .....	1	5		10	38		1	55
Dakota .....				1				1
Delaware .....				1	1			2
District of Columbia		1		1	4			6
Georgia .....				2	3			5
Idaho .....		1						1
Illinois .....	3	3		5	6			17
Indiana .....					1			1
Iowa .....		1		4				5
Kansas .....				3	1			4
Kentucky .....	1		1	1				3
Louisiana .....	1	1			1			3
Maine .....					4			4
Maryland .....				3	2			5
Massachusetts .....				5	22			27
Michigan .....					1			1
Minnesota .....		1		3	2			6
Mississippi .....	1				2			3
Missouri .....		2		1	6			9
Montana .....		2			2			4
Nebraska .....		1						1
Nevada .....				1				1
New Hampshire .....				4	4			8
New Jersey .....	44	28	8	45	68	6	1	200
New York State .....	39	30	8	63	105	12		257
North Carolina .....		1		2	3			6
Ohio .....		4		5	10			19
Oregon .....					2			2
Pennsylvania .....	1	2		6	14	1		24
Rhode Island .....		2		3	12			17
South Carolina .....	1				1			2
Tennessee .....				1	2			3
Texas .....				3	5	1		9
Utah .....	1			1				2



Residence.	School of Arts.	School of Mines.	School of Political Science.	School of Law.	School of Medicine.	Graduate Department.	Course for Women.	Total.
Vermont .....	1		1	5	1			8
Virginia .....		2			8			10
Washington .....				2	1			3
West Virginia.....		1		1				2
Wisconsin .....	1			2	6			9
	268	225	97	451	598	70	10	

*Outside of the United States :*

Bermuda.....					1			1
Canada .....		1		1	7			9
Central America....					8			8
Cuba.....		2						2
England .....		1		1				2
Germany.....				1				1
Japan .....			1	1	1			3
Mexico .....				1				1
Nova Scotia.....					2			2
Porto Rico .....					1			1
Russia.....	1							1
Turkey .....					1			1
U.S. of Colombia,S.A.		2						2
	1	6	1	5	21			34
Totals .....	269	231	98	456	619	70	10	1,753

## DEGREES CONFERRED IN 1888-89

## In the School of Arts :

Bachelor of Arts.....	33	
Master of Arts.....	9	
Doctor of Philosophy.....	3	
Master of Arts. Honorary.....	1	46

## In the School of Mines :

Engineer of Mines .....	14	
Civil Engineer .....	17	
Bachelor of Philosophy (In the course of geology and palæontology).....	1	
“ “ “ (In the course of analytical and app. chem.),.....	6	
“ “ “ (In the course of architecture).....	11	
Doctor of Philosophy.....	1	50

## In the School of Political Science :

Bachelor of Arts.....	4	
Bachelor of Philosophy.....	2	
Master of Arts.....	18	
Doctor of Philosophy.....	4	28

## In the School of Law :

Bachelor of Laws.....	178	178
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## In the Collegiate Course for Women :

Bachelor of Arts.....	1	
Bachelor of Letters.....	1	2

## In the School of Medicine :

Doctor of Medicine.....	176	176
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Total 480

## DEGREES CONFERRED IN 1889-90.

*During the year.*

## In the School of Mines :

Civil Engineer .....	2	
Bachelor of Philosophy (In the course of analytical and app. chemistry),.....	1	
Sanitary Engineer .....	2	5

## In the School of Political Science :

Bachelor of Philosophy .....	2	
Doctor of Philosophy .....	1	3

## In the School of Law :

Bachelor of Laws .....	10	10
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*At commencement, June 11, 1890.*

In the School of Arts :

Bachelor of Arts .....	39	
Master of Arts .....	9	
Doctor of Philosophy .....	1	49
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In the School of Mines :

Engineer of Mines .....	6	
Civil Engineer .....	17	
Metallurgical Engineer .....	6	
Bachelor of Philosophy (In the course of analytical and app. chemistry),	5	
Bachelor of Philosophy (In the course of architecture) .....	16	
Doctor of Philosophy .....	6	56
		<hr/>

In the School of Political Science :

Bachelor of Arts .....	4	
Bachelor of Philosophy .....	4	
Master of Arts .....	14	
Doctor of Philosophy .....	7	29
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In the School of Medicine :

Doctor of Medicine .....	180	180
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Honorary Degrees :

Doctor of Divinity .....	1	
Doctor of Laws .....	2	
Doctor of Letters .....	1	4
		<hr/>

Total 336

It is my painful duty to call attention to the loss sustained by the college during the year, in the death of two of the trustees, Mr. John J. Townsend, who died December 5, 1889, and Mr. Charles M. DaCosta, who died June 22, 1890. Mr. Townsend was an alumnus of the college of the class of 1841, and he had been a trustee since 1879. Mr. DaCosta was an alumnus of the Class of 1855, and he had been a trustee since 1886. It is with the highest sense of its value to the college that I make record of Mr. DaCosta's munificent legacy of \$100,000, to be used,

at the discretion of the trustees, for the endowment of a professorship. The testimony of a man so widely trusted, who had every opportunity to know the exact condition of the affairs of the college, that such a contribution from his estate was worth the making, ought to be of the utmost service to the college. Mr. DaCosta was in the fullest sympathy with the efforts being made to make Columbia a university worthy of the city of New York, and he understood that a university, by its very nature, needs all the funds it can command. A college, using the word in a pedagogic sense, which sets before itself as its aim instruction in a definite curriculum, may possibly have command of means enough. But a university, again speaking pedagogically, never can have enough. By a university I mean an institution where instruction can be had in the highest reaches of every known department of knowledge, and where researches are always being carried on to widen the domain of what is known and taught. Because knowledge grows, the university must grow with it, and such growth is as costly as it is essential. But costly as it may be, it is worth while, and because it is worth while I gladly place upon record my grateful appreciation of this noble gift to Columbia from her loyal son. Would that she might have had more years of his faithful and valuable service before this last great kindness of his had gone into effect! Taken in connection with President Barnard's similar thoughtfulness in making Columbia his residuary legatee, this gift of Mr. DaCosta's ought to make it clear to the city that Columbia can use wisely and well much larger resources than she can now command.

In this connection it is my pleasure to report the following gifts of money to the college, which have passed through the treasurer's hands during the year under review. Other gifts of more or less magnitude have been received, often in the form of books or collections, but they have not passed through the hands of the treasurer.

From C. F. McKim, for Architecture .....	\$20,000
From E. D. Page, for the Library .....	100
From Samuel D. Babcock, for the Library ....	500
From Jesse Seligman, for the Seligman Fellowships.....	1,000
From H. McK. Moore, for the Library.....	200
From A. C. Bernheim, for the Library .....	100
From Samuel P. Avery, for the Avery Architectural Library .....	15,000
From C. F. McKim, for the Library.....	50
Total .....	<u>\$36,950</u>

The library has received :

From Oscar S. Straus.....	\$250
From Dr. Wm. E. Wheelock.....	125
From Mrs. Jane Dolbear.....	50
From Anonymous.....	200
	<u>\$625</u>

These gifts were not received in cash by the librarian or treasurer, but were expended for works by the persons who obtained the gifts for the college, and the books were turned into the library.

The gift from Mr. McKim of \$20,000 was for the establishment of two travelling fellowships in architecture of \$1,000 each, which are to be awarded in 1891 and every alternate year thereafter.

The gift of \$15,000 from Mr. Avery is for the endowment of the Avery Architectural Library, established as a department of the college library by Mr.

and Mrs. Avery as a memorial of their son, the late Henry Ogden Avery, who was an architect in this city. In addition to this sum of money, Mr. and Mrs. Avery have presented to the college the valuable books contained in the library of their son, and have ordered other books for the collection which are to cost a further sum of \$15,000. These generous gifts from Mr. McKim and Mr. and Mrs. Avery will add much to the advantages of the architectural course in Columbia College. It is believed that they will also prove of substantial benefit to the profession. It is especially the purpose of the Avery Library to furnish access to rare and costly works not easily within reach of professional men.

Appended to this report is a tabular list of the changes affecting the personnel of the college.

Dr. L. Harold Jacoby, who has been absent on leave to accompany the United States eclipse expedition under Professor Todd, after the eclipse was over, left the U. S. S. *Pensacola* at Capetown and has been at work for several months, with my consent, at Capetown, in the Royal Astronomical Observatory, under Professor David Gill. He returns in season for the new academic year, having had much valuable experience and having been so fortunate as to do some original work which called forth the hearty encomiums of Professor Gill.

Respectfully submitted.

SETH LOW,

*President.*









